SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIX.—No. 11. ESTABLISHED 1845. NEW YORK, SEPTEMBER 9, 1893. $3.00 A YEAR. WEEKLY.

THE WORLD'S COLUMBIAN EXPOSITION—TRIUMPHAL ARCH AND PERISTYLE.

The Court of Honor of the World's Columbian Exposition is bounded on the north by the huge Manufactures building, on the south by the glorious façade of the Palace of Agriculture, to the west rises the majestic dome of the Administration building and on the east is the Peristyle with a triumphal arch bearing the Columbus Quadriga. In the center of the Court of Honor is the main basin, with the MacMonnies fountain at one end and the outlet to the lake under the Triumphal Arch at the other. The Court of Honor itself is the most beautiful feature of the Exposition, and at night, when the buildings are outlined with electric lights, the effect produced is enchanting beyond description. The perfection of proportion, which is so noticeable in the Exposition and which is so wonderful when the number of different architects is considered, is nowhere better illustrated than in the Peristyle and the Triumphal Arch.

The Peristyle connects the Casino and the Music Hall and forms the eastern end of the Court of Honor.

The Peristyle was designed by Mr. C. B. Atwood in the classical style, and is free from what architects calls nervousness, which is apt to take away the dignity that is so essential in a work of monumental grandeur. The Peristyle is composed of forty-eight columns, twenty-four on each side of the arch. The columns symbolize the States and Territories. Above the balustrade on pedestals, which form the continuation of the columns, are heroic figures fourteen feet high, representing Eloquence, Music, etc. Just below the cornice are the names of the States of the Union. The Peristyle affords a shady walk on a warm day, and its protection is not to be despised, for the colonnade measures 234 feet from each corner building to the Columbian portico. In the center of the Peristyle, and forming the water gate or outlet of the main basin, rises the majestic Triumphal, or, more properly speaking, Columbian Arch. The arch somewhat resembles the *Arc de Triomphe* of the Place du Carrousel in Paris. Between the two columns on each side are colossal figures representing the genius of Navigation and Discovery. Each of the figures stands on the prow of a vessel. These pieces of sculpture are the work of Bela L. Pratt, of New York. Over the arch are angels blowing trumpets. Just under the cornice on both the lakeward and landward sides appear the names of the great explorers, Cartier, Champlain, De Soto, Ponce de Leon, La Salle, Cortez. High up on the pedestal which supports the Quadriga is an inscription which should make all Americans thrill with pride: "*Ye Shall Know the Truth, and the Truth Shall Make You Free.*"

There is no more fitting monument to commemorate victories of either war or peace than a triumphal arch surmounted by a quadriga. A triumphal arch, if not properly treated, becomes simply a brutal manifestation of power, as in the Brandenburg Gate at Berlin. In the present instance the genius of Mr. D. C. French has given us a remarkably strong and satisfactory group. Four horses full of fire champ their golden bits and paw the ground. Each pair is held in check by a draped female figure. In the chariot stands a majestic figure of him to whom the western world is now doing honor—Christopher Columbus. On each side is an outrider with a banner. Although the Peristyle is built of staff, the clever artificers have wrought so cunningly that the whole appears to consist of white Pentelic marble. It is to be regretted that the beautiful Peristyle with its noble arch cannot be perpetuated in more enduring materials, but it is safe to say that all who have viewed this beautiful creation will find it indelibly fixed upon the memory.

THE WORLD'S COLUMBIAN EXPOSITION—TRIUMPHAL ARCH AND PERISTYLE, COURT OF HONOR.

How to Show Lines of Electric Force.

The following experiment for making visible lines of electric force is described by Herr Bruno Kolbe: Into a flat cylindrical vessel pour purified anhydrous oil of turpentine to a depth of about 2 cm., and add some sulphate of quinine. To the rim of the vessel attach two wire springs, adjusted so that the two small metallic balls at their ends dip into the turpentine. Stir the quinine with a glass rod so as to distribute it evenly, and place the vessel on a black cardboard. Join the two wires to the terminals of an influence machine, and turn very slowly. At once the white crystals group themselves so as to form beautiful curves, representing the "lines of electric force." The form of these curves recalls that of the brush discharge of the influence machine. Prof. Weiler, of Esslingen, gives the following experiment: Prepare a milky mixture by stirring up finely divided quinine in oil of turpentine. On sending a series of discharges through it, a clearance is produced at the positive pole, and the particles cluster round the negative pole, arranging themselves in streamers directed along the lines of force.

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ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
Remit by postal or express money order, or by bank draft or checx.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

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MUNN & CO., Publishers,
361 Broadway, New York.

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NEW YORK, SATURDAY, SEPTEMBER 9, 1893.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 923.

For the Week Ending September 9, 1893.

Price 10 cents. For sale by all newsdealers.

THE LATEST ARMOR TRIAL AT INDIAN HEAD.

On Saturday, August 26, a trial of armor took place at the Naval Ordnance Proving Ground, at Indian Head, which resulted in the provisional acceptance of about 370 tons of nickel steel armor from Carnegie, Phipps & Co.

The specimen plate that represented the group, which includes armor for the battleships and the conning tower of the Indiana, was an 8 inch barbette plate for the Oregon. Its curve subtended an arc of 120° on a radius of about 8 feet; it was 10 feet 7 inches horizontally and 5 feet 4 inches high, secured to an oak backing with 13 three-inch bolts. The backing at the medial line of the plate was 47 inches thick. The plate was nickel steel, acid treated, possessing a tensile strength of about 98,000 and an elongation of 20 per cent.

The gun was a modern 6 inch breech-loading rifle, mounted on a central pivot carriage, at a muzzle distance from the plate of 61 feet.

The projectile used was a Carpenter armor-piercing shell weighing 100 pounds.

First Round.—Charge of powder, 37·84 pounds. Dupont's brown prismatic; striking velocity, 1,762 f. s. This round was for the premium cracking test, the conditions of which were that the projectile must not get through, and the plate must not show through cracks to the edge.

The point of impact was 21 inches below the upper edge of the plate and about 18 inches to the right of the medial line, the impact being practically normal.

The projectile struck the point aimed at, got its nose just through and rebounded to the gun platform, where it was picked up near the carriage. The marks on the oak planking showed a spiral movement of the shell when it landed over the boards, where it knocked over a stand of blind projectiles, then returning, came to rest under the gun, with its nose pointing toward the plate. It was apparently undeformed, but decidedly cracked, and its point was highly polished and smeared with melted copper from the rotating band. On cooling, the shell began to flake off around the swell, disclosing a grain of finest metal.

The plate was not cracked and showed no other damage than the hole of impact, the edges of which were turned up with a fringe 2·35 inches high. This round decided the acceptance of the plate for the cracking test, but it failed to win the premium cracking test.

Second Round.—Charge of powder, 48·3 pounds; striking velocity, 2,012 feet per second. This round was for the premium perforation test. The shell must not penetrate the backing. The premium offered was $30 per ton for the whole group represented by the plate.

The shot struck the plate 21 inches to the left and below the first point of impact, on the medial line of the plate, penetrated the plate, 47 inches oak backing and 10 inches of additional wood, where it remained. The plate was not cracked, and showed only a clean, fringed hole.

While the plate failed to win a premium for the contractors, the test was eminently satisfactory to the government inspectors. The trial was conducted by Lieutenant Newton E. Mason, U. S. Navy, in charge of the proving ground, in the presence of Captain W. T. Sampson, the Chief of the Bureau of Ordnance, and a number of prominent steel men and ordnance officers. The Carnegie Company was represented by Mr. Hunsecker and their naval agent, Lieut. Stone.

THE PURIFICATION OF WATER IN WELLS AND CISTERNS.

We have recently described and illustrated an electric purification process for water from the Croton watershed. The existence of vested rights therein involving the disposal of sewage by villages or individual houses has made this object hard to attain. Tracing one source of contamination to a restricted area, the purification process we have alluded to has been applied thereto with considerable success. The process virtually amounts to treatment of the water with hypochlorites and other highly oxidized salts. These decompose the offensive organic matter and make the water quite innocuous.

Liquids form a peculiarly efficient vehicle for the sustenance and dissemination of the lower forms of life forming the dangerous class of "organic matter." The presence in liquids of certain of these germs means disease for those who drink it. While science has not yet reached the point of distinguishing between all safe and unsafe bacteria, it seems to have reached the point of being able to destroy them all cheaply.

The country districts are notorious among sanitarians for bad water supply. The picturesque well, with its old oaken bucket, is often situated so close to a source of sewage contamination that it becomes a center for the dissemination of typhoid fever, diphtheria, or other deadly malady. In the supply of water for country houses it would seem the sanitary chemist had a good field for his operations. If it is possible to treat one of the affluents of Croton Lake cheaply and effectively, so as to make a marshy and probably sewage-contaminated water pure in the sanitary sense, how much easier an object of attack would be the well of the country boarding house, or of the seashore hotel, now so often overshadowed by at least a suspicion of unhealthfulness. In many cases houses in the country depend upon rain water for the supply. This water collected in subterranean cisterns would seem to have every title to the highest grade of purity, especially if the first rainfall is discarded by a special by-pass. Yet cistern water often acquires a very unpleasant taste, which is traceable to no visible or discernible impurity.

The treatment of such cases would seem to be simple, and a formula for each case based on an examination of the water might easily be deduced. An agent, such as the hypochlorites, added in predetermined quantity might be found applicable. Potassium permanganate or binoxide of hydrogen would also seem available reagents and of undoubted efficiency. The highly colored permanganate salt would be of special advantage, as it might be added to the limit of discoloration, thus in itself supplying its formula of application. We have before this had occasion to describe direct aeration applied to the purification of water; the simple bubbling of air through water is found to remove odor and taste. It is possible that many cases of local trouble with water might be treated by a proper air pump for the injection of atmospheric air through water in the cistern or well.

The chemist's permanganate test for organic matter in water consists in the addition of an acidulated solution of permanganate of potash of known strength in measured volume to the water to be tested. Organic matter in the water destroys the salt. Its solution is of a very strong violet color, the merest trace of it imparting a rose tinge to water. In the test, after addition to the water, the rose-colored mixture is allowed to stand for a definite period. If decolorization takes place, more is added until the water retains a faint red color, when it is assumed that the decolorizing power of the water is exhausted. By calculation the quantity of oxygen absorbed from the permanganate is determined and is reported as oxygen required to destroy organic matter in the water in question. The application of such a process to a cistern or well would seem quite possible under proper management, such as might be formulated by a competent chemical authority. If a colorless salt were used, then of course there would be no direct method of knowing when enough had been added. If, however, a virtually non-poisonous substance were used, an excess of which would not be disagreeable, then it would be quite possible to devise such a system as we describe to be applied by any person.

The rendering sea water potable by the addition thereto of silver citrate, thus substituting sodium citrate for sodium chloride, has been suggested for use in cases of shipwreck, and the exact formula for its application has been published. As sea water is virtually of constant composition, a formula was of easy preparation. For organic matter in water, something which constantly varies in amount, no universal formula can be produced, and the best that can be done might be the use of some agent which even in excess would not affect the water injuriously, while destroying organic matter.

John Rae.

Dr. John Rae died at his home, in London, on July 24, after a prolonged illness. Dr. Rae was born in the Orkney Islands. He studied medicine at the University of Edinburgh, and after graduation there he took his degree as licentiate of the Royal College of Surgeons before he was twenty-three years of age. He served for a time as surgeon on a ship of the Hudson's Bay Company, and in 1845 accepted the command of an expedition to the Arctic Seas to endeavor to complete the survey of about seven hundred miles of the coast forming the shores of a large bay, which Parry had failed to accomplish. This expedition, which proved successful, was the beginning of a series of voyages of discovery that made Dr. Rae famous as an Arctic explorer. He was a fellow of the Royal Society, fellow of the Royal Geographical Society, honorary correspondent of the Geographical Society of America, and honorary member of the National History Society of Montreal. The Founders' Gold Medal of the Royal Geographical Society was awarded to him several years ago.

IN both France and Germany one-fourth (¼) reduced to a decimal is written as 0,25; in England it is written 0·25 (always with the period at the top of the line), and in the United States in this way, 0.25. France and Germany always use the comma (,), England and the United States the period (.), the only difference being the manner in which it is placed upon the line. Sir Isaac Newton is given the credit of originating the present English method of using the decimal point, his reason being that by placing it at the top of the line it could be distinguished at a glance from the "full stop" punctuation mark. All English mathematicians use the mark in the way proposed by Newton, and the period as a sign of multiplication.

The Electrical Congress was held during the week ending August 26, and proved to be one of the most interesting as well as one of the most valuable congresses that has been held. The work was divided into three sections, "Pure Theory," "Theory and Practice," and "Pure Practice." The third section was by all odds the most attractive so far as attendance was concerned. In addition there was a Chamber of Delegates composed of representatives appointed by the leading governments of the world. All the sessions of this chamber were held in secret and important results were accomplished, which were embodied in a report, especially in the direction of adopting units for electrical measurements. These included the ohm, ampere, volt, coulomb, farad, joule, watt and henry. This last unit derives its name from the eminent American electrician and is the unit of induction. Many valuable papers were read at the meetings of each section, but the discussions brought out even more instruction than did the papers. Long distance transmission received a great deal of attention. The members of the congress received much attention and visited the Exposition to inspect the Intramural Railway and its plant, the movable sidewalk, the Exposition electrical plant, and special features in the Electricity building. An important feature of the programme was a lecture by Nikola Tesla on "Mechanical and Electrical Oscillators," which touched upon new principles in the electrical field.

The live stock exhibit, which opened to the public on August 22, to continue for about three weeks, was a very popular attraction. It included some twelve hundred head of cattle—Short Horn, Hereford, Aberdeen-Angus, Galloway, Devon, Jersey, Holstein-Friesian, Ayrshire, Guernsey, Red Polled, Polled Durham, Dutch Belted, and Brown Swiss; over eight hundred horses, including French Coach, German Coach, Cleveland Bay, Percheron, Clydesdale, Shire, French Draught, Belgian, Suffolk Punch, Hackney, Morgan, Arab, Americo-Arab, French Trotter, and Russian; besides Shetland and other ponies; jacks and jennets, and mules; eighteen hundred sheep and fifteen hundred hogs. The animals were shown in the live stock pavilion, which is in the shape of a large Roman amphitheater, and has seating accommodations for ten thousand people. Forty stables were built by the Exposition in which to house the animals, each stable being 200 by 42 feet in size and provided with modern conveniences. One of the most attractive features of this exhibit was the display of twenty-one horses sent by the Czar of Russia. Some of these horses are almost priceless in value and special attendants were sent from Russia to care for them. Emperor William, of Germany, also sent many fine horses from his stables. The awards in this department aggregated over $150,000. Fine animals were contributed from Canada as well as from many sections of the United States.

The week ending August 26 was the banner week up to that time, so far as attendance at the Exposition was concerned, as it exceeded 1,000,000. The average attendance for the six days was over 163,000. Illinois day, which was August 24, there were 240,909 paid admissions. Special exercises were held at the State building and there was a large parade. Other special days of the week were West Virginia day, Delaware day and Colored People's day. A feature of Delaware day was the distribution of a carload of luscious peaches.

A prince of the royal family of Japan reached Chicago the last week in August to attend the Exposition. He was in time to be informed of the many awards that the juries are making to exhibitors from his country. No country has, proportionally, made so fine an exhibit as Japan, and it is reaping the benefit now by receiving more awards than any other country.

The great telescope which Charles T. Yerkes has presented to the Chicago University is set up complete, so far as outward appearance is concerned, in the center of the main aisle at the north end of the Manufactures and Liberal Arts building. The part of the instrument exhibited was manufactured by Warner & Swasey, Cleveland, Ohio. It is mounted on a heavy iron column 43 feet high and weighing 50 tons. The polar axis is of steel and 15 inches in diameter, while the declination axis is of steel and 12 inches in diameter. The tube, as now seen without the lenses, weighs 6 tons, is 64 feet long, 52 inches in diameter at the center and tapers toward the ends. Three electric motors of one horse power each control all the motions of the instrument, and one of these motors automatically winds the driving clock, keeping the tube in exact sidereal time. This instrument was opened to the public with formal ceremonies, many eminent scientists being present.

Foreign commissioners, correspondents and jurors to the number of fifty or more have been given an excursion into the Northwest over the Great Northern and other railways through the wheat fields of Minnesota and South Dakota. The main purpose of this excursion was that these foreign visitors might see the extensive manner in which farming, and especially wheat raising, is carried on in the Northwest. One of the special events of the excursion was witnessing the cutting of an eleven thousand acre wheat field. The trip was carried out with great success and was a revelation to many of the visitors.

In one portion of the Manufactures building the publishers of the principal magazines have taken pains to show what the magazines are made of. Here may be seen the originals of illustrations that have secured fame for their designers all the world over. Nor are the manuscripts less interesting. Some dainty pieces of literature, which one might think had been put on paper with the finest of crow quills, are actually found as though the manuscript was the product of a very blunt stick. On the other hand, there are original manuscripts of important and popular works, like the original copy of "Ben Hur," for instance, so fine as to task the sharpest eyes. When looked at through a magnifying glass, however, the small handwriting is found to be very distinct, each letter being carefully formed and accurately united. Readers of magazines, after trying to decipher the copy of some favorite authors, will ever after gratefully appreciate the services rendered by typesetters and pressmen.

Saturday, August 26, was special day in the Palace of Mechanic Arts, and every machine in the building that could be put into operation observed the day. People crowded the building from early in the morning until late at night, watching the various exhibits; riding on the electric traveling cranes, which had been fitted up with balconies for the purpose; collecting many unique souvenirs of the day, and going about from one special feature to another. The special event of the day was printing a souvenir newspaper. This event began at the paper-making machine, where wood pulp was made into paper. In the meantime compositors were busily at work at the opposite side of the building, setting type with the linotype machine. By the time the paper was made the type was set, and in sixty-three minutes from the time the pulp was put into the machine, souvenir papers were printed. The celebration had many ridiculous features connected with it. One large pump supplied a constant stream of lemonade, and on the lagoon in front of the building sports were carried on, such as climbing a greased pole, hanging over the water, and boat crews battling with each other with streams of water.

Such a profusion of electric lights as one sees in the buildings and on the grounds of the World's Fair has probably never been viewed by mortal man before, so says the *Electrical Review*. Arc and incandescent lamps are everywhere. The white buildings reflect the lights and make the scene as bright as day. On those nights when every lamp is burning, the electric fountains playing, and fireworks are shooting up from the lake, the scene is almost beyond description. No picture can do it justice—it must be seen. The Grand Basin is outlined in living fire, the surrounding buildings glow with light, the massive dome of the Administration building, crowned with electric lamps, rises heavenward in graceful curves, while the electric fountains shoot forth ever-changing sprays of colored water. Involuntary applause breaks forth among the spectators ever and anon, as they sit and stand about in open-eyed astonishment at the grandeur of an artistic accumulation of electric lights.

A very interesting novelty is the Columbus egg, as it is called, shown in the Westinghouse lighting exhibit. On a table on the west side of the space are placed a pair of large induction coils for exhibiting the effects of the two-phase rotary current. A wooden table is placed over these on which metal objects commenced to spin around as soon as placed upon it. Two copper eggs, one small, the other about eight inches long, when placed over these coils commence whirling and soon turn up on the end and continue to whirl. In the room provided for the exhibition of high tension currents a series of transformers and Leyden jars are so arranged as to give heavy discharges over glass and rubber plates.

In the Electrical Palace the electric stoves and cooking utensils are objects of attraction and interest. As they have no pipes, and give rise to no smoke or dust, they readily lend themselves to ornamentation. They can also be placed in any convenient place or position. Some of the stoves are very elegant and would adorn a parlor.

Probably the largest photograph at the World's Fair is to be seen in the gallery of the Mining building. It belongs to the exhibit of the Standard Oil Company. Among other things are transparencies illustrative of oil works and distilleries, storage tanks, etc., in various parts of the country.

Recently the company had a large relief map made, and the work of securing a good photograph of this on glass was given to J. K. Hillers, of the United States Geological Survey, who is an expert in large photographs. A good sized negative was made of the relief map, and upon a paper print from the negative were drawn the States, lakes, and names. From the print a negative 30 inches square was taken, and from this an enlarged transparency on glass, 7 feet long by 4 feet 2 inches wide, was made.

No ordinary camera could do the work, so the photographer made a camera of a room 12 by 15 feet in size. The room was blackened inside and made light and even air tight. The shutter was placed in the window and the lens in the shutter. Mr. Hillers had three expert photographers assisting him in the work, and they built a silvering vat which used $250 worth of nitrate of silver, and a developing vat, both in the gigantic camera, so that probably for the first time the camera itself was used as the developing room.

The work was focused on a ground-glass plate, the same size as the photograph. This was done by three men holding the plate and moving it back and forth until the proper focus was secured. Then the sensitive plate was made ready. This was a piece of American plate glass, three-eighths of an inch thick, made and polished for this particular picture. A work of this nature had never before been attempted on such a large scale. Mr. Hillers was obliged to feel his way, for he did not know just how long the plate should be exposed. A test was first made with a small plate, and this gave him an approximate measure of time.

With rare good fortune, the first exposure of the new plate was a success, and a beautiful photograph was secured. Then a specially arranged hose was turned against the big plate to wash away the chemicals. It took an hour to do this. After the toning process came the matter of varnish. This was the critical phase of the operation. The plate was laid on four rubber balls, one at each corner, and Photographer Hillers tilted it while an assistant poured on half a gallon of varnish. Success still remained with him, and the transparency was ready for its colors.

The oil-bearing districts are shown in yellow, and each particular region where oil is actually brought to the surface is shown in the color of the oil itself. It took four months from the beginning, when the first negative of the map was taken, to finish the transparency. It is valued at $5,000.

A New Yorker's Impressions of the World's Fair.

Taking the fastest express from New York for Chicago, going in twenty hours, as comfortably almost as if in one's drawing room, the World's Fair city is reached without any appreciable fatigue or discomfort.

In entering the city of Chicago, much time is lost because the tracks run through a traveled street at grade, requiring a very slow speed. To a New Yorker, accustomed to the rapid speed on the Park Avenue viaduct and tunnel, this was especially noticeable.

In approaching the city, as most of the roads do, from the foot of Lake Michigan, the first glimpse of the roofs and domes of the Fair buildings is obtained, and an idea of their magnitude is realized. Landing in the city, one is struck with the peculiar smokiness of the atmosphere and the dinginess of all the buildings, the sunlight having a sort of yellowish cast. There is a special league in Chicago organized to stop the smoke nuisance, which by constant agitation is expecting to bring about an improvement. By the general use of electricity as a motive power, great changes may some day be accomplished. But the smoke is now tolerated, as a Chicagoan says, because the fuel is cheap, and is thereby one of the means of enabling the factories to prosper.

The court or finest general view of the World's Exposition is acknowledged to be from the lake. It is really the front view of the aggregation of buildings, and is very impressive. Starting from the foot of Van Buren Street in the large whaleback steamer Christopher Columbus, a delightful sail out on the lake and parallel with the shore for about eight or nine miles supplies a continual panorama of interest.

One observes the swift and frequent so-called "cattle trains" traversing the Illinois Central tracks close to the lake shore; then the large substantial hotels surrounding the north end of the grounds are seen, and beyond, close to the domes and turrets of the foreign buildings, is a big, tall, unsightly blotch of a building inclosed in black scaffolding, called the "Spectatorium," located close to the water's edge. But when this is passed the long facade of the Palace of Liberal Arts facing the lake, the pier, the Peristyle, and through it the gilded dome of the Administration Palace, the Agricultural Palace, and glimpses of the Court of Honor are observed, with an *ensemble* and symmetry of architecture that is grand and imposing.

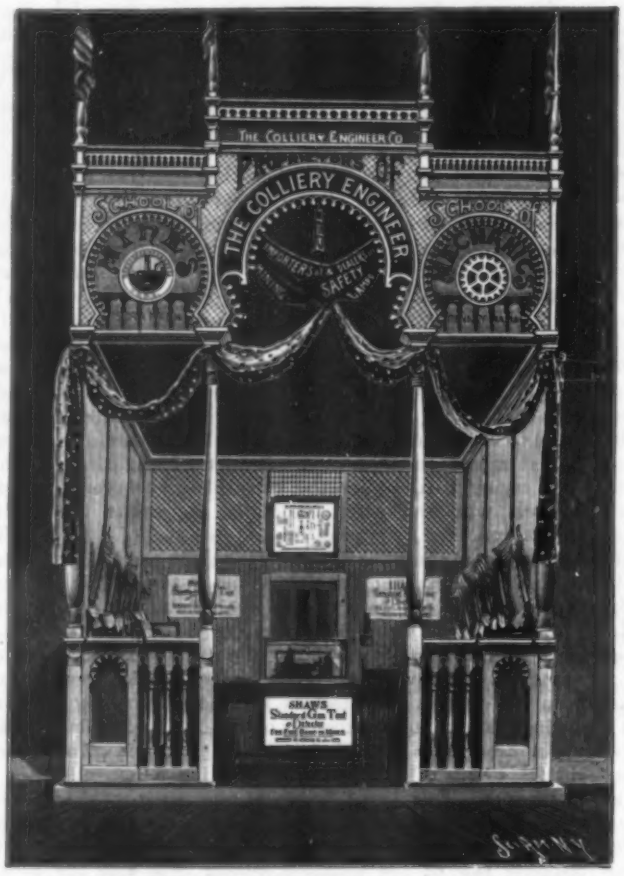
At the pier the first novelty to be seen (after passing

(*Continued on page 166.*)

EVOLUTION OF THE SAFETY LAMP AS SHOWN AT THE FAIR.

The display of the Colliery Engineer Co., of Scranton, Pa., consists of an evolutionary exhibit of safety lamps for use in gaseous mines. All types of lamps, from the primitive inventions of Sir Humphry Davy and Dr. Clanny down to the most approved types of modern lamps, are shown. This exhibit was prepared at the request of the Mining Department of the Exposition and is not intended as a competitive one. It is the most complete collection of safety lamps ever exhibited. The Colliery Engineer Co., through its journal the *Colliery Engineer*, and its correspondence schools of mines and mechanics, has naturally paid great attention to the subject of the safe and economical working of mines, and naturally was well qualified to arrange this important exhibit. Through the reputation of the *Colliery Engineer*, and a thorough knowledge of the subject on the part of its officers, the lamps of all the leading manufacturers of the world were secured, and they are exhibited side by side. No attempt is made to show the superiority of any one make over the others, but a handsome pamphlet containing information regarding the principles of the leading types, together with information as to the best types for either testing gases or for working at the face of the mine, is distributed. The matter contained in this pamphlet is taken from the instruction paper on safety lamps used in the Correspondence School of Mines, which is also owned by this company.

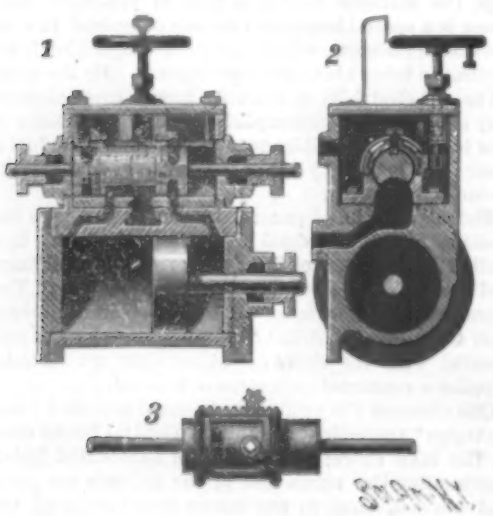
The Correspondence School of Mines is an institution that teaches all branches of science connected with mining by correspondence, and during the past two years has enrolled over 2,000 students. Students are not required to leave their homes or neglect their business. Everything is taught by correspondence and each student receives special attention, as he is a class by himself. The Correspondence School of Mechanics, under the proprietorship of the same company, is a similar institution for the education of students in the various principles of mechanics and mechanical drawing. The facilities offered working men, who cannot afford to leave their homes or neglect their work and who desire such education in either mining or mechanics as will enable them to advance in their business, are most excellent, and the terms of tuition, including the lesson and question papers, are very low. Payments for instruction can be made monthly, and this places the advantages of the schools within the reach of any working man. The schools are both indorsed by all prominent mining and mechanical engineers who have examined into the system, and numerous students have been recommended to the schools by prominent educators in all parts of the country.



THE WORLD'S COLUMBIAN EXPOSITION—THE COLLIERY ENGINEER" EXHIBIT OF SAFETY LAMPS.

A BALANCED STEAM ENGINE VALVE.

The valve shown in the illustration, recently patented by Mr. Augustin Roche, of Butte City, Montana, is completely balanced, both as to the inlet and the exhaust. Figs. 1 and 2 are side and transverse sectional views of the improvement as applied, and Fig. 3 is a plan view. Fastened in the bottom of the steam chest, on the cylinder, is a casing having in its bottom ports registering with those of the cylinder and with the ports in



ROCHE'S STEAM ENGINE VALVE.

a cylindrical valve sliding in the casing, the latter inlet ports registering with two ports in the top of the casing which open into the interior of the steam chest. The stuffing boxes in which the valve stems slide are screwed into position, and when removed the valve may be passed through the apertures at the ends of the steam chest. To prevent the turning of the valve, a screw in the top of the casing projects into a longitudinal recess in the top of the valve. The cut-off mechanism consists of a saddle with flanges sliding in guideways on the valve casing, there being on one side of the saddle a rack engaged by a pinion on the lower end of a shaft turning in a stuffing box on the cover of the steam chest. The shaft is actuated by a hand wheel to move the saddle so that it will cover to a greater or less extent the ports in the top of the casing opening into the steam chest. The top of the hand wheel has a graduation on which is a fixed pointer, to indicate at all times the position of the saddle, and the wheel may be actuated from a suitable governor instead of being turned by hand. From the valve being inclosed in a separate casing, it is completely counterbalanced, both as to the live steam and the exhaust, and the casing serves to relieve the valve of the pressure of the steam entering the steam chest. The several parts of the valve are readily removable from the steam chest for repairing or other purposes.

Sucrol.

Sucrol is the name given to paraphenetal carbamide, a harmless substance of deliciously sweet taste, produced by adding a solution of potassium cyanate to muriate of amidophenetol. It is easily crystallizable in small white tables having a melting point of 160° C. (320° F.) It is soluble in alcohol and ether and in hot muriatic acid, also in hot acetic acid, as well as in all the solvents usually employed. Diluted alkalies or acids do not act on it. Its solubilities appear from the table given below:

1 gramme dissolves in 30 grammes of hot water.
1 gramme dissolves in 800 grammes of cold water.
1 gramme dissolves in 25 grammes of alcohol 90 per cent.
1 gramme dissolves in 80 grammes of alcohol 45 per cent.
1 gramme dissolves in 480 grammes of glycerine.

Dr. Henry Paschkis has made exhaustive experiments to determine its value and applicability. He finds that sucrol has no influence on the circulation, respiration, or digestion, nor on the nervous system in general. It is particularly adapted for use by diabetics, dyspeptics, and those suffering from obesity. Its sweetening power is 200 times that of sugar. There is a slight difficulty in the use of the powdered preparation, as it is not easy to moisten it; but this is *absolutely absent* if it is used *in the shape of fine crystals.* To sweeten tea, coffee, etc., it is best to pour them hot on the sucrol in the cup.

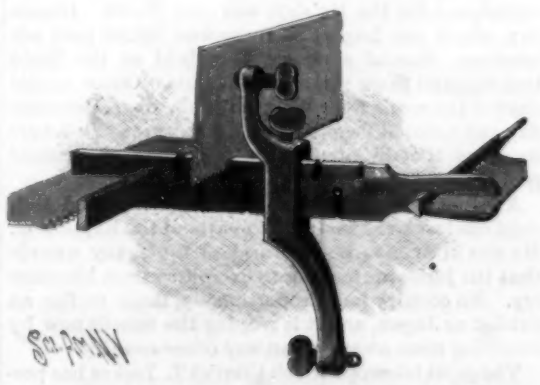
The First American Railway.

Mr. Lewis Cheney, of Chelsea, Mass., now 85 years old, enjoys the distinction of being the only man now living who worked upon the famous "Granite Railway," built in 1826, in Quincy, Mass., chiefly to transport stones for building Bunker Hill monument. He chances also to have been the man who drove the horses which hauled the cars which carried the first load of stones over the road. The record given by the "Columbian Sentinel" of this historical event, whose importance was then little dreamed of, was as follows: "This railroad, the first we believe in the country, was opened on Saturday (Oct., 1826), in the presence of a number of gentlemen who take an interest in the experiment. A quantity of stone, weighing 16 tons, taken from the ledge belonging to the Bunker Hill Association, and loaded in three wagons, which together weighed five tons, was moved with ease by a single horse from the quarries to the landing above Neponset Bridge, a distance of more than three miles. The road declines gradually the whole way, from the quarry to the landing, but so slightly that the horse conveys back the empty wagons, making a load of five tons. After the starting of the load, which required some exertion, the horse moved with ease in a fast walk. It may, therefore, be easily conceived how greatly the transportation of heavy loads is facilitated by means of this road. A large quantity of beautiful stone already prepared for the Bunker Hill monument will now be rapidly and cheaply transported to the wharf at the termination of the railroad, whence it will be conveyed by lighters to Charlestown. The road is constructed in the most substantial manner. It rests on a foundation of stone, laid so deep in the ground as to be beyond the reach of frost, and to secure the rails on which the carriage runs effectually against any change in their relative position, they are laid on stones of 8 ft. in length, placed transversely along the whole extent of the road at a distance of 6 to 8 ft. from each other. The space between these stones is filled in with smaller stones or earth, and over the whole between the rails a gravel path is made. The rails are formed of pine timber, on the top of which is placed a bar of iron. The carriages run upon the iron bars and are kept in position by a projection on the inner edge of the truss wheels. The wheels are of a size considerably larger than a common cart wheel.

"We learn from a gentleman who has visited the principal railroads in England, that in point of solidity and skill of construction this is not exceeded by any one there."

A CONVENIENT SAW SETTING DEVICE.

With the device shown in the picture saw teeth of all ordinary sizes may be accurately set to any desired degree, and the sharp points of the teeth be protected by a clearance in the setting tool, by means of which also the truing up of the teeth to even lengths and at right angles with the blade may be readily effected. The improvement has been patented by Mr. Carl M. Kardell, of Marshfield, Oregon. The main blade of the tool is of tempered steel, and has in both edges notches of various sizes and depths for the different sizes of saw teeth to pass into when the saw is being set, the bottom portions of the notches being enlarged to form a clearance for the sharp points of the teeth. A reversible and adjustable cross bar is set tightly upon the main blade by a thumb screw, and at each end of the bar is a thumb screw, either one of which bears against the side of the saw blade in setting, the amount of the setting being regulated by the adjustment of the bar and one of the thumb screws at its ends. The main blade also has at one end a slot terminating in a space into which a flat file may be stuck, for filing evenly the points of the teeth of a large saw, while the other or handle end of the blade has a smaller slot, for truing the teeth of small saws, a space being provided at the bottom of the slot for the insertion of a three-cornered file. Both of these slots are slightly widened near the file-receiving spaces to give room for the set of the teeth.



KARDELL'S SAW SETTING DEVICE.

BREECH-LOADING rifles were invented in 1811, but did not come into general use for many years. It is estimated that over 12,000,000 are now in actual service in the European armies, while 3,000,000 are reserved in the arsenals for emergencies.

THE GRIFFIN ROLLER MILL AT THE FAIR.

In the Mines and Mining building are two exhibits of the Bradley Fertilizer Company, of Boston. One is in group 63, where an elevator for roller mill is shown for moving, storing, and delivering ores, and the other is a roller mill exhibit, in group 64, shown in our illustration. These mills have fully proved themselves to be among the most successful machines known for pulverizing all refractory substances, such as quartz, ores of all kinds, etc., effecting a great saving in working expense as compared with stamp mills and other appliances for reducing ores, while the first cost of the mill is only about a quarter of that of a stamp mill. The mill is constructed upon a new principle, which involves the use of a ring or die, on the inner surface of which a roller runs, the roller being carried by a rotating shaft hung on a universal joint. This joint is inclosed in the driving pulley, which revolves in a horizontal plane. The ring or die is inclosed in a pan in the base of the machine, and the roller carries shoes or plows, which throw up the material contained in the pan below the ring, so that it is acted upon by the roller. As the lighter portions of loose material come in contact with the screens arranged above the ring or die, they escape through the screen into the annular casing surrounding the space above the ring. The operation of grinding is continuous, the material being constantly agitated and thrown up, so that it is acted upon by the roller as it travels around the inner surface of the ring. As the grinding is done by the pressure of the roller against the ring or die as it travels around, no power is wasted, and the product secured is in the most satisfactory condition. It is found upon microscopic examination that, whatever the nature of the substance treated in the mill, there is always a clear fracture, thus securing results that for nearly every purpose are superior to those obtained by rubbing or abrasion. The range of work of the mill is very great, and many of them are now employed on phosphate rock, carbon foundry facings, plumbago, Portland rock, cements, etc. It will work either wet or dry, and operates equally well on substances as hard as flint or as soft as lime, grinding them to any desired degree of fineness. Grinding to 60 mesh or finer, its capacity is two to four tons per hour.

THE GRIFFIN ROLLER MILL AT THE FAIR.

CREAMERY AND DAIRY APPARATUS AT THE FAIR.

The large exhibit in the Agricultural building of the Vermont Farm Machine Co., of Bellows Falls, Vt., well displays the leading productions of what is said to be the largest manufactory of dairy and creamery apparatus and supplies in the United States, if not in the world. The company was incorporated in 1873, and manufacture everything for handling milk and cream in the dairy, creamery and cheese factory—creamers, churns, butter workers, all styles and sizes of cream separators and butter extractors for dairy and factory, the Babcock milk testers, etc. The company fit up dairies and butter and cheese factories with every article needed to run them. A leading specialty of their manufacture is the Cooley creamer, seen near the right in the picture. It has proved to be the leading milk-raising apparatus in the world, having taken first place in all dairy countries. The butter made by this process has been awarded twenty-five gold medals at the fairs and expositions in the different parts of the world. It received the highest award at the Paris Exposition, and scored the highest points at the July exhibit of the Columbian Exposition at Chicago. The Cooley system of setting milk for raising cream consists of putting the milk into cans, which are submerged and water-sealed in the creamers, the milk being automatically skimmed while the cream is raised. The processes are covered by patents, which have been sustained by the U. S. Circuit Courts in Iowa and Vermont, and within two months by the U. S. Court of Appeals, New York. The Cooley creamer is made in several different styles, the favorite one having an elevator attachment, in which there is no lifting of milk cans by hand. The process of skimming the cream from the milk with this apparatus is so rapid that the average time is less than one minute per can.

The milk cooler and aerator is shown at the extreme right. This is an indispensable article to all dairymen who sell their milk, as it will cool the milk to any degree desired in less than two minutes. The square box churns have two features that creamery men find to be very desirable. One is the square openings that are placed at the corner of the churn. These are so large that it practically amounts to taking the side of the churn off, and are more popular than the trunk churns, from the fact that they answer all the purposes of the trunk churns, and at the same time are less liable to leak. Another feature is the building of the wood pulley around the body of the churn. This is becoming very popular among creamery men. All iron parts of the cover are galvanized.

The United States cream separator, shown at the extreme left of the picture, furnished only by this company, has not been on the market as long as some other devices of this character, but it is claimed to be superior to the older machines. It is a centrifugal machine which is said to separate the cream from the milk so thoroughly that the skimmed milk will in no case show more than a trace of fat, and in many cases absolutely no fat.

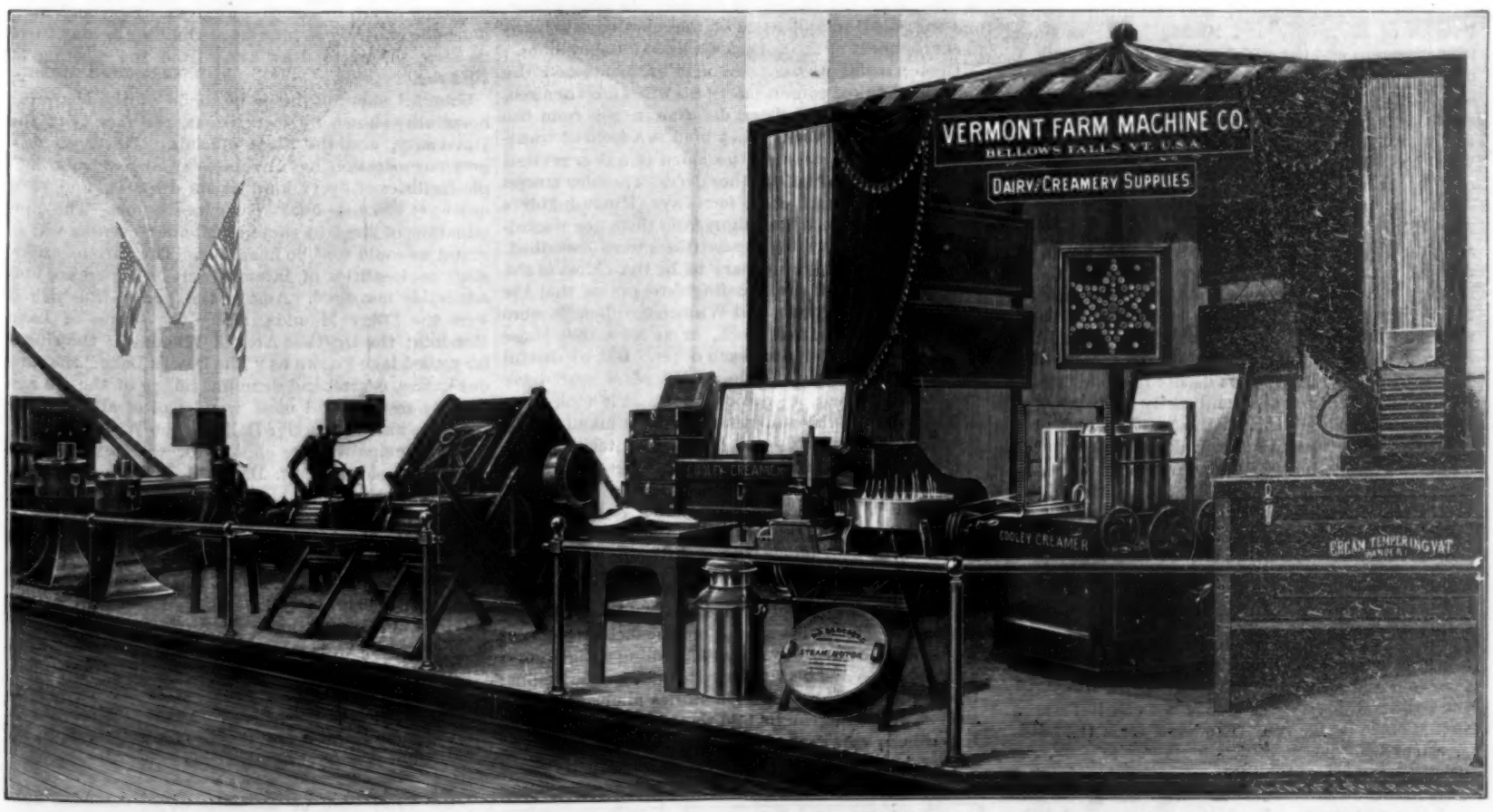
The capacity of the creamery machines of this class runs from 1,300 to 2,300 pounds of milk per hour, and the dairy sizes from 300 to 600 pounds of milk per hour. The skim milk is discharged from the bowl at the bottom, and is delivered from a spout at the side of the frame into a tank, obviating the necessity of siphoning the milk or water out of the bowl.

All who are in any way interested in the business of handling milk or cream should send for one of the company's illustrated catalogues.

Fall of a Meteor.

At 4 o'clock in the morning of July 29 the heavens above Suffern, N. Y., became suddenly suffused with an unusual glow. Soon a large bluish-tinted ball made its appearance, high in the northwest, and pursued an apparently slow but steady course earthward to the southeast; lighting up the whole neighborhood and leaving in its wake a long, bright, gauzy tail. As it approached the zenith its speed seemed to increase. Suddenly it burst into a multitude of variously colored fragments, which were dispersed in all directions. The glow ceased a moment afterward, and then the report of the explosion was heard. One of the pieces of the meteor fell, north of Mahwah and two miles south of Suffern, in a field of oats belonging to Farmer Conrad. It formed a hole in the ground, four feet in diameter, like a newly-dug well, the sides of which had fallen in. The grain round the edges of the cavity was burned to a crisp, and the leaves on one side of an apple tree in the vicinity were shriveled as if by intense frost. Three miles north of Suffern another piece of the shattered visitor fell. Two pieces only of the remains have thus far apparently been discovered.

THE Cherbourg "digue" is 4,120 yards long, having two arms inclosing the entrance.



THE WORLD'S COLUMBIAN EXPOSITION—CREAMERY AND DAIRY EXHIBITS OF THE VERMONT FARM MACHINE CO.

A New Yorker's Impressions of the World's Fair.

(*Continued from page 163.*)

the admission gates) is the endless sidewalk railroad operated by electricity, which extends over the entire length of the pier. For five cents a person may ride upon it all day if desired. In approaching the buildings from the pier, the splendid group of statuary surmounting the Peristyle appears in strong relief against a blue sky, while the other single statues on either side and underneath form an appropriate setting or surrounding. Once the Peristyte is reached, the massiveness of its three rows of columns becomes apparent and the solid pavement underneath brings one to a realizing sense of Venice. A paved arched bridge is provided in the center of the Peristyte over a narrow waterway which connects the basin of the Court of Honor with the lake. Steam launches pass through this and under the bridge in going from the Court of Honor to the lake. The Peristyle fronts directly on the lake, making a pleasant place to sit on a hot afternoon, as the cool breezes from the lake draw through between the columns.

After crossing the floor of the Peristyle inward, the first unobstructed view of the various buildings in their majestic proportions is had. Close to the spectator at the lake end of the Court of Honor, isolated on a pedestal rising out of the water, is the mammoth gilded statue of the Republic, facing westward toward the Administration building, which causes the statue to be seen first from the back. The statue is 60 feet high and cost $25,000. The two arms are raised upward parallel with each other, one hand holding a flag and the other a staff with a liberty cap on it. It is very imposing and can be seen from nearly every point of view. To the right of the Peristyle as one enters from the lake is the Palace of Music, decorated with statues of heroic size to correspond with those on the Peristyle. This palace is 130×250 feet in size and its interior construction is so perfect that it is said to possess the finest acoustic properties for orchestral purposes of any hall in the United States; 2,500 persons can be seated in it. It is here that Theodore Thomas held his daily concerts, which were so little appreciated by the general public. At the other end of the Peristyle, opposite and symmetrical with the Palace of Music, is the Casino, in which a restaurant is located equal in every respect to those of New York. On the south side of the Casino, secured to the wharf, is the famous Santa Maria, a complete copy of the Columbus ship, and it is usually crowded with visitors.

There is another direct connection here with the lake. The huge Palace of Agriculture stands west of the Casino, and the waterway between the two is bridged over. Right near the Santa Maria, secured to the dock adjoining the Agricultural Palace, are the other caravels of Columbus, the Nina and Pinta, admittance to which is refused. On the other side of the water, opposite these vessels, standing apparently on an island, is the reproduction of the La Rabida monastery, containing many interesting relics of Columbus. This building contrasts strongly in its simplicity with the grand architecture of the adjacent buildings. Passing westward along the south side of the basin, directly in front of the long facade of the Agricultural Palace, an excellent view of the Palace of Liberal Arts, bounding the opposite side, is obtained, and also glimpses of the Palaces of Electricity and Mining, while at the extreme western end the stately gilded dome of the Administration building looms up as a fitting background and center for so many buildings. The bright greensward between the walk in front of the buildings and the pier line, relieved at boat landings by massive white statues, forms a pleasing contrast with the white of the buildings.

Walking still westward until the west end of the Agricultural Palace is reached, another waterway is seen at right angles to the length of the basin, and parallel with the lake front. Looking south, the Columbus monument and colonnade, imitating somewhat the Peristyle, is seen, and north is observed in the distance the Wooded Island and the dome of the Illinois State building, while the long western facade of the Palace of Liberal Arts shows its size to advantage.

Standing in the open plaza directly in front of the Administration building, at the western end of the basin, the expensive and grand MacMonnies fountain (called the Columbian fountain) is the most conspicuous object; its odd shape and curious combination of picturesque statuary mark it truly as one of the chief works of art in the Exposition. The color is white like the buildings. On each side of this fountain are two large electric fountains whose basins are sixty feet in diameter.

In the daytime these fountains do not present any attractiveness, but at night the multi-colored illumined fountain is particularly beautiful. On the eastern porch of the Administration building, facing the basin and lake, is St. Gaudens' beautiful statue of Columbus in heroic size. The view from the balcony of the eastern porch of this building is particularly pleasing, bringing in, as it does, the fountains, the basin, lined on each side with beautiful green lawns, and the artistic facade of the Agricultural Palace, while in the distance can be seen the statue of the Republic and the lake through the columns of the Peristyle. South of the Administration building stands the immense Palace of Machinery, with its long row of Corinthian columns, and on the north are the Mining and Electrical Palaces, simple but harmonious in shape and idea with the other larger buildings. In the porch of the Electrical Palace is a beautiful statue of Franklin drawing electricity from the clouds. West of the Administration building is a large open space, bounded by the Central Railroad depot, an imposing building and very large. In the gallery of this building is a spacious writing room, equipped with every facility for correspondence. The building seemed to be too large for the purpose, and there was much waste room. Just west of this are the train sheds for thirty-five tracks, having accommodations for thousands of visitors. Not more than one-third of the tracks were in active use. Coming to the Fair in this way, *via* the Illinois Railroad, the visitor is landed close to the Administration building, and has for a first view the delightful vista of the basin and lake from the eastern porch of that building.

The aluminum bronze dome of this building, shining like gold, looming up 275 feet above the ground, can be seen from a great distance, and is particularly conspicuous at night when covered with rows of hundreds of incandescent lights. The designers have allowed ample space between the buildings properly to show them off, and while apparently near together, as observed by the eye, they are in reality separated some distance apart, as can be proved by attempting to walk from one to the other.

One noticeable difference from the Centenial Exposition in 1876 is the absence of cheap and rapid communication between these large buildings.

Electricity is used so successfully in propelling boats about the lagoons and canals that it is surprising electric carriages were not introduced to take visitors about the grounds for a small sum. The need of such simple, direct transportation should have been thought of. The only method adopted is the use of rolling chairs, to be hired at 50 cents per hour, or electric launches at 50 cents a round trip. The rolling chair privilege has proved to be somewhat of a failure, thousands preferring to walk rather than pay the high figures. At Philadelphia one could reach any building for five cents by frequent trains. In my next some of the notable exhibits will be described.

MEETING OF THE AMERICAN ASSOCIATION AT MADISON.*

The concluding portion of Dr. Hovey's report is as follows:

BILOXI INDIANS, OF LOUISIANA.

Prof. J. O. Dorsey, chairman of the Anthropological Section, described a peculiar tribe of aborigines that he visited in 1892 and 1893 for ethnological study. He said that the name "Biloxi" was a corruption of the name they gave themselves, and which simply meant the First People. They were known to have lived in 1699 at Biloxi Bay, Mississippi; but in 1763 they removed to Louisiana, and of the entire tribe only seventeen individuals remain alive. They formerly existed in three divisions, named for the deer, the grizzly bear, and the alligator, and each of these branches refused to eat the meat of the animal whose name they bore.

Among social peculiarities may be mentioned the fact that a Biloxi cannot marry his wife's aunt or niece, but might marry her sister, differing in this from the Sioux and other tribes. They hold to a form of transmigration. For instance, the spirit of a deer revived and took the body of another deer. Thunder stories should only be told on a fair day. Hummingbirds always tell the truth, and signs from them are regarded as sacred. Various superstitions were described. The Biloxi language appears to be the oldest of the Siouan family. There are linguistic proofs that the Biloxi, Hidasta, Tutelo, and Winnebago dialects were offshoots from a parent stock, or at least that those speaking them dwelt near each other. But by careful investigation it appears that 1,500 years must have elapsed since their separation, and that it took place in Virginia. In this connection, the fact may be mentioned that Dr. Washington Matthews entertained the section by rendering speeches, war songs, and sacred songs of different Indian tribes, by the aid of the phonograph. He had his own cylinders. His account of the difficulties of inducing the Indians to speak or sing into the instrument were amusing.

BEAR AND WOLF STORIES.

For forty years Prof. W. H. Brewer, of Yale College, has been a steady attendant on the meetings of the A. A. A. S., and always has something bright and original to say. This time his theme was the instinctive interest children take in stories about bears and wolves. Nothing can be told them about lions, tigers, leopards, or cats that so fascinates them as the class of stories named above. He has repeatedly experimented on this matter with very young children, even as young as five years, and has never found their interest to flag as long as he was willing to talk about bears. He told a child five years old a story about a grizzly bear that fed on the carcass of a whale near his camp on the Pacific coast, and when he saw that boy a year later he climbed on his knee and demanded the same story over again. Bear stories never grow old. Children may forget about Samson and the lion, but never about the she bears that revenged the bald-headed Elisha. To some extent the same interest is manifested in wolf stories, *e. g.*, the fascinating tale of "Little Red Riding Hood." Now, why is so much interest taken in these animals? Two explanations may be offered. One is that it is entirely a matter of education, due to the consecutive traditions of the nursery, and the place they have in juvenile literature. The other is that this interest is instinctive. The latter is the true explanation. The origin of instinct is a mooted question among naturalists. Most evolutionists have held it to be due to the inheritance of acquired experience, memory, habits, and tastes. This is now denied by naturalists of certain schools, but held to by others. Our own belief is that the matter now considered belongs to inherited memory. Bears and wolves have been the most destructive of all wild beasts known in our latitude and climate. The destruction of children by these animals in parts of Europe is still more remarkable. Formerly it must have been very great, and must have made a permanent impression on the mind. We know that several of our finest breeds of dogs were originally evolved as wolf dogs. The fear inspired by bears and wolves in the childhood of our civilization, and the education of successive generations in this fear, descends to us as an inherited memory, or instinct, of sufficient force to impart a fascination to all stories about them.

Among papers read in other sections the following may be named as attracting special attention: "Natural Gas from New Lisbon, O.," by W. A. Noyes. "A Tempered Steel Meteorite," by E. Goldsmith. "Negative Lightning," by W. LeConte Stevens. "The Rotating Disk in Photometry," by E. S. Ferry. "The Latitude Variation Tide," by A. S. Christie. "Automatic Fire Sprinklers," by D. S. Jacobus. "Use of the Name 'Catskill' in Geology," by Prof. J. J. Stevenson. "The Fossil Sharks of Ohio," by E. W. Claypole. "Photography as Applied to Recording Micro-organisms in Artificial Cultures," by G. F. Atkinson. "Lichens of the Black Hills," by T. A. Williams. "The Roots of Orchids," by Prof. M. B. Thomas. "Relations of Production and Price of Silver and Gold," by Henry Farquhar.

The total number of lectures, addresses and papers read this year was 179, many of which were doubtless as interesting as those that happened to arrest the writer's attention. All the more important ones will appear in the published proceedings of the society. Nothing more is now attempted than to give a kind of bird's eye view of the great annual gathering of men of science, and some idea of what they talked about. The entire number in attendance as registered was 290, a less number than has usually been enrolled. It had been hoped that the proximity to Chicago and the World's Fair would attract a larger number; but the reverse has proved to be the case. So many congresses of one kind or other, and such diversified objects of interest at the Fair as may there be seen, served to draw away from the meeting at Madison.

Grateful mention should be made of the charming hospitality shown by the citizens, the faculty of the University, and the State officials. Never on any previous occasion has the Association had such ample facilities of every kind at its disposal, and such quiet yet spacious quarters for its sessions. The illumination of the lake shore on Monday evening was as grand as could well be imagined. The various excursions to localities of interest were well planned and admirably managed. Among the points thus visited were the Effigy Mounds, along the shores of Lake Mendota; the Driftless Area of Wisconsin; the singular walled lake known as "The Devil's Lake;" the various kames, eskers, and drumlins telling of the ice age and its results; and most wonderful of all, the picturesque and instructive Dalles of the Wisconsin.

The principal officers chosen for the next meeting are: As president, Prof. Daniel G. Brinton, of Media, Pa.; vice presidents, Section A, G. C. Comstock; Section B, W. A. Rogers; Section C, T. H. Norton; Section D, Mansfield Merriman; Section E, Samuel Calvin; Section F, S. H. Scudder; Section G, L. M. Underwood; Section H, Franz Boas; Section I, Harry Farquhar. The office of permanent secretary is held by Prof. F. W. Putnam; Prof. H. L. Fairchild, of Rochester, N. Y., is general secretary; and Prof. J. L. Howe, of Louisville, Ky., is secretary of the council. The treasurer of the association is Prof. William Lilly, of Mauch Chunk, Pa. The next meeting will be held in some Eastern city, probably in Brooklyn, N. Y., although it is not yet determined.

THE total cost of the Suez Canal exceeded £20,000,000.

* Continued from the SCIENTIFIC AMERICAN of September 2, page 147.

The Great Depression in Manufacturing Industries.

The effect of the prevailing monetary stringency or general depression in trade on manufacturing industries throughout the country becomes a matter of interest at this time, in view of the numerous reports of the closing of manufacturing establishments.

The earlier stage of the squeeze in credits, as is usually the case, was seen in the extreme liquidation in Wall Street, and the second phase, in logical order, has been and is being observed in its effect on manufacturing industries.

Returns have been received concerning nearly 800 establishments, nearly all of which are of more or less prominence, and all of which have closed their doors for one cause or another since June 1. The report likewise includes the best available information concerning the discharge of the number of employes of silver mining companies in the far West, as well as of employes rendered idle by the shutdown of iron ore mines. So far as changes of the character referred to at a few of the larger business centers are concerned, many reports by trade unions or statistical bodies having access to such data have been employed.

A summary of the results of the investigation shows that no fewer than 463,000 industrial, building trades and mining employes have been thrown out of work within the period specified, due to the absolute closing of the establishments at which they were engaged or the shutting down of work at the mines.

Of this large aggregate no fewer than 80,000, or 17 per cent, were engaged in the production or the manufacture of iron and steel; 55,000, or 12 per cent, in woolen, silk and cotton mills or in the manufacture of clothing; 50,000, or 11 per cent, in leading lines in building trades at a few of the larger cities; 44,000, or 9·5 per cent, in silver mining and allied industries, and 41,000, or 9 per cent, in coal mining and coke producing. Of the aggregate of these five classes, 270,000, it is possible that as high a proportion as 30 per cent are customarily idle for a short time at this season of the year.

It is noteworthy that out of the approximate aggregate of 800 establishments reported shut down about 79 per cent declared this action is taken because of the prevailing "depression in general trade," a "lack of orders," "stringency in the money market," or "inability to make usual discounts due to tight money," while only 6 per cent state that the shutdowns are due to usual vacations at this season of the year, or owing to the necessity for making repairs or for taking inventories. Strikes or wages disputes are given in explanation of the closing down of only 2 per cent of the establishments reported, while failures in business or other embarrassments, fires or other disasters, account for the shutdown of about 3 per cent of the concerns reported. Less than 1 per cent state in so many words that shutdowns are owing to "impending tariff changes."

When it is realized that this report, complete as it may be, is quite incomplete so far as the country at large is concerned, even with respect to manufacturing establishments which have wholly closed down for one reason or another, and that it takes no account of the thousands of reductions of working forces in other manufacturing establishments, in commercial houses, or by transportation organizations, large and small, it becomes plain to the casual observer that there are in all probability no fewer than 800,000 or 900,000 idle employes of manufacturing, commercial and other enterprises at this time who were nearly if not all actively employed three or four months ago, and that not more than from one-sixth to one-fifth of this aggregate may fairly be said to have been out of work during the past two months owing to the "customary midsummer shutdowns," or to the necessity for repairs or to taking of inventories, even though the not infrequent midsummer wages dispute in the iron and steel industries be taken into account.—*Bradstreet's.*

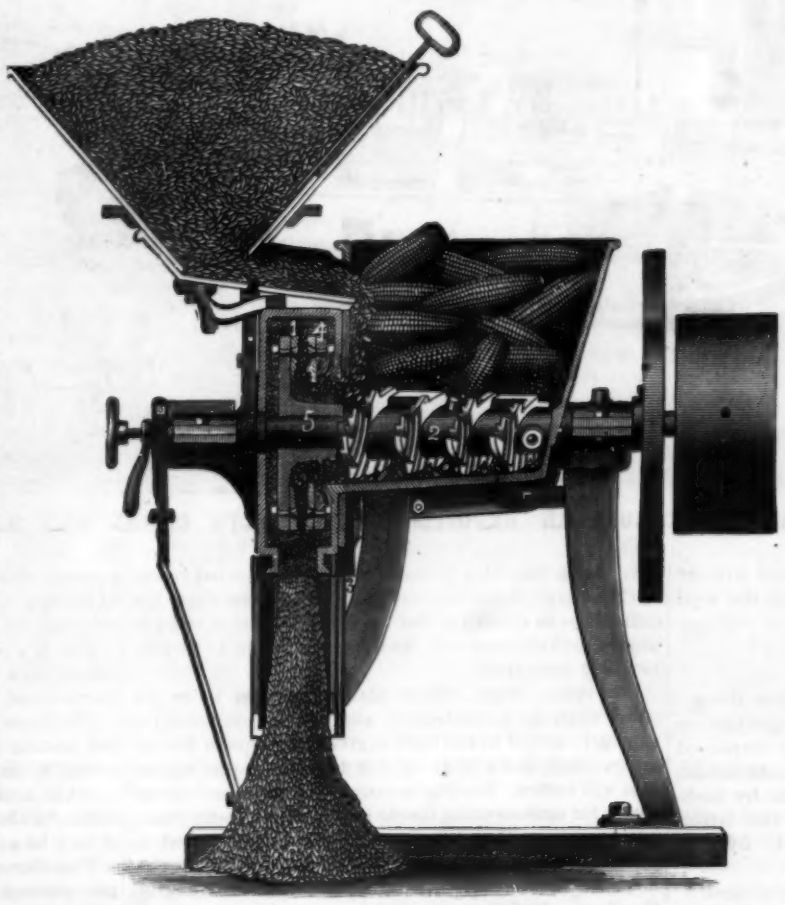
Promethium.

This is an alloy containing 60 per cent of copper, 38 per cent of zinc, and 2 per cent of aluminum. These metals are melted together and sodium or other metallic flux capable of oxidation at the temperature of the mixture is stirred in. The quantity used should be sufficient to flood the surface of the mixed metals. The sodium increases the tenacity of the alloy and prevents deterioration by exposure to air or sea water. The degree of hardness may be varied by varying the proportions of the ingredients. The alloy is termed "promethium" or "titanic metal."

THE QUAKER CITY GRINDING MILL AT THE EXPOSITION.

In section E of the Agricultural annex at the Columbian Exposition may be seen one of the widely known Quaker City grinding mills, manufactured by A. W. Straub & Co., of Philadelphia, for grinding corn and cobs, feed and table meal. The concern was established a quarter of a century ago, and these mills have been brought to a high degree of perfection, the most recent improvement being the adoption of a thrust ball bearing for the back end of the spindle. This improvement can be added, when desired, to the mills already out. In the illustration the machine is shown in section grinding oats to lubricate the disks, while grinding corn and cobs and mixing the product. The cobs fall at one end and slide at the other into the case around the "drunken" circular saws, which cut the cobs into three or four sections, the teeth on the sides sawing the sections fine, when they pass through the mill with the corn.

The double reduction grinding disks, an enlarged section of one of which is shown in the small view, are cast of steel and readily interchangeable. The conveyor flights upon the sawtoothed inner edge act like a fan to draw cool air and grain into the mill at a very low speed, the grain being first cut fine, then rolled, mashed and mellowed, so that it enlarges nearly one-third in bulk. In the picture, the location of the grinding disks is indicated at 1, the training ring, 4, being on a universal joint, free to move every way, except to revolve with the running disk. The crushing saws, 2, are formed on a sleeve cast fast with lead to the spindle, 5, which is of steel. The degree of fineness is regulated by turning a small hand wheel on the end of the temper screw, and there are three discharge spouts with tin covers, allowing the desired one to be opened, either side or downward.



THE WORLD'S COLUMBIAN EXPOSITION—THE QUAKER CITY GRINDING MILL.

Agriculture in France.

The fifth and last volume of the reports of the United States commissioners to the Universal Exposition held at Paris, in 1889, has recently been distributed from the State Department. It is a profusely illustrated volume of 900 pages, and constitutes the report of Professor C. V. Riley, as expert commissioner for the eighth group and representative of the Department of Agriculture, on the agricultural phases of the Exposition. The volume is divided into two parts, the first devoted to agriculture, vine cultivation and wine making, useful and injurious insects, field trials of implements, and stock shows, while the second part is a history of the agricultural exhibit and agricultural products of the United States. In the preparation of the first part of the report Professor Riley was aided by Messrs. Amory Austin and C. L. Marlatt, while the second part, in addition to Professor Riley's reports on the international congress of agriculture held during the Exposition, and upon injurious and beneficial insects in the United States, contains reports by experts, mostly connected with the Department of Agriculture, upon such topics as the meat industry of the United States, associated dairying in New England, the leather production of America, tobacco, viticulture, vegetables, cereals, etc. Some 219 cuts and 77 plates are included in the two parts of the volume.

The chapters in the first half of the report upon the agronomy and agricultural statistics of France and her methods and appliances for agricultural instruction are of great interest and value to the agriculturists of this country, as exhibiting the wise liberality with which the French republic fosters agriculture and the generous provision which the state makes for instruction in the science, many features of her system, Professor Riley thinks, being well worthy of our imitation. The Minister of Agriculture in France is a cabinet officer, and liable to frequent change, in common with the other ministers of the state; but his chief subordinate, the Director of Agriculture, is practically a permanent officer, the present (1889) incumbent having held the office for some 20 years. Three other directors also report to the Minister of Agriculture, charged respectively with forestry, the stud (Haras) and waterworks. There are also various councils, committees and commissions for the consideration of technical affairs, such as the superior commission upon the phylloxera, the consulting committee upon epizootic diseases, etc.

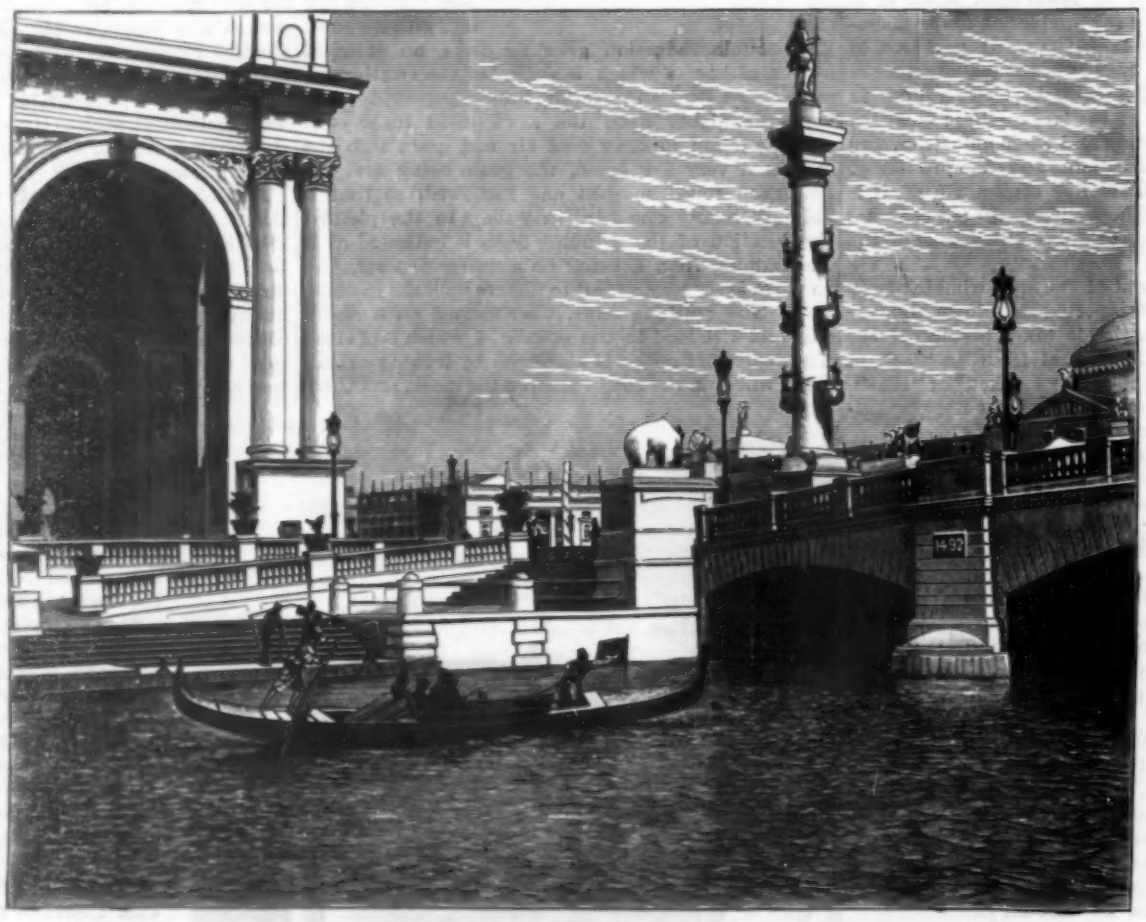
Agricultural instruction is provided for by the National Agronomic Institute at Paris, three national schools of agriculture, one national school of horticulture, twenty-seven practical agricultural schools, seven farm schools, thirteen primary agricultural schools, ninety departmental professorships of agriculture and courses in normal schools, professorships of agricultural chemistry in various faculties of science, seventeen courses of agriculture in lyceums, colleges, primary schools, etc., and fifty-six agronomic stations and agricultural laboratories. This generous provision puts agricultural instruction within the reach of almost all, and the recently instituted order of the *Merite Agricole* is held up to all sincere agriculturists as a goal to be striven for only second to the historic decoration of the Legion of Honor.

That the extent to which scientific agriculture is fostered in France is not exaggerated is shown by the magnitude of the agricultural interest. With a population (in 1886) of a little over thirty-eight millions, the capital employed in agriculture in France exceeds 100,000,000,000 of francs or about 20,000,000,000 of dollars. The figures are almost inconceivably large, and only intelligible when it is remembered that the great majority of the holdings of land in France are very small, and that therefore the closest cultivation is practicable or rather necessary. Of 5,670,000 holdings in France, 2,167,000 occupy less than one hectare (1 hectare equals 2·47 acres), while only 30,000 occupy over 100 hectares (247 acres), almost half the holdings being thus less than three acres in extent. A comprehensive exhibit of the appliances for agricultural instruction in France was made at the Exposition, and other countries made similar but less comprehensive exhibits of the same subject. All of these the report gives a succinct account, but the greater part of the chapter on this subject is devoted to France, and deservedly so, for, says the author, "probably in no other country in the world has agriculture received greater attention from the government."

The second part of the volume forms an exhibit of certain phases of agriculture in the United States, each chapter written by an expert. The monographs composing this part of the report were translated into French for distribution during the Exposition, and their preservation in English in this permanent form is to be highly commended, since they form the most complete and modern treatise upon American scientific agriculture we have seen. The volume has an appendix of several pages devoted to expert opinion from French and English newspapers on the American exhibit, showing a high degree of appreciation of it. The report as a whole is a most valuable contribution to agricultural literature, and many of its chapters might with advantage be reprinted separately for special distribution.

THE WORLD'S COLUMBIAN EXPOSITION—THE NORTH CANAL AND BRIDGE.

The Fair grounds contain many picturesque bits in which the buildings, statuary and the water of the lagoons and canals form happy combinations. We present herewith a view of the bridge which affords a passageway between the Electricity building and the Manufactures building. This bridge begins just beyond the luminous fountain at the end of the lagoon, and is the main thoroughfare to the great Manufactures building. The body of water in front, over which the sharp-prowed gondola swiftly skims, is the North Canal that empties into the main basin, which is at right angles to it. At the right of the picture the dome of the beautiful Agricultural building will be noticed. The large column directly over the bridge is one of the six rostral pillars which are placed at intervals around the main basin. The pillar is ornamented with the prows of galleys and is surmounted by a statue of Neptune. The balustrade which runs along the Manufactures building from north to south is decorated by a number of large plants. The magnificent flight of steps afford a landing place for the launches and gondolas. Balustrade, bridge, column and statuary are all covered with the dazzling white staff which has given the Exposition the name of the "White City." As will be seen by the illustration, each arched entrance to the Manufactures building is covered by a small dome which is painted by an American artist. These little domes, which were introduced for decorative purposes, deserve careful study, as they are painted by the most eminent men in the profession. Blashfield, Reinhart, Beckwith, Shirlaw, Cox, Simmons, Reid, Weir, Melchers, F. D. Millet and Earle, each have specimens of their work upon the domes. The subjects, with one exception, are treated in the classical style, and, represent the arts of peace and war. It seems almost impossible that this huge building would seat 300,000 persons. The architect of the Manufactures building was Mr. Geo. B. Post, of New York, its length is 1,687 feet, and it is 787 feet wide. It is said to be the largest roofed building ever erected. In the construction of this mammoth edifice 17,000,000 feet of lumber, 12,000,000 pounds of steel, 2,000,000 pounds of iron and five car loads of nails were employed. The glass for the roof filled forty cars. The roof is 212 feet 9 inches high.



THE WORLD'S COLUMBIAN EXPOSITION—THE NORTH CANAL AND BRIDGE.

Aluminum Flashlight.

Professor Glasenapp emphatically advocates the use of aluminum in place of magnesium for the production of flashlight. He states that aluminum, if employed in the form of bronze powder, is equal to magnesium as a source of light in taking photographs by flashlight, and that it is much cheaper then the latter. The following mixture is recommended by the author:

Aluminum powder	21, 7 parts by weight.
Sulphide of antimony	13, 8 " "
Potassium chlorate	64, 5 " "

In preparing this mixture the same precautions are to be taken as in the case of magnesium flashlight. As the rapidity of combustion of the above mixture, one seventeenth of a second has been found out. Two grammes of the mixture were burnt in a small heap, 2 cm. long and 1 cm. wide. With regard to the chemical intensity the author has found, by exposing gelatine plates beneath a Warnerke actinometer to the light of the above mixture and to that of other mixtures prepared with magnesium, that by employing equal quantities of metal the aluminum light is superior to the magnesium light, though not very considerably. The speed of combustion is slower (about one-fifth of a second) if the following mixture is used:

Aluminum powder	30 parts by weight.
Potassium chlorate	70 " "

Electroplating with Copper.

In no branch of the electroplaters' art has there been so much progress made in recent years as in that of copper plating. With improved solutions and methods, copper plating is becoming a more important industry every day, and the following notes on some new applications and methods may prove of interest to your readers:

The application of copper electrically deposited to protect and ornament architectural iron work is, perhaps, the most important use and deserves consideration first. This use is now firmly established and a plating department is recognized as a necessary adjunct to all large iron works. There is no paint or other like protection known that will prevent iron exposed to the weather from rusting in time. But when iron is covered with a sufficiently heavy coat of copper it is rust proof. The amount of copper required to do this varies. For rolled sheet steel or iron where the surface is smooth and free from sand holes, from 8 to 10 ounces of copper per square foot of surface will be sufficient. Where rough cast iron work is to be plated, 14 to 16 ounces will be required. These amounts are greater than is generally given in books treating on this subject, but from practical experience the writer has found that to give a protection that will last as long as the structure will stand, and to prevent entirely any appearance of rust, the above amounts are necessary. The first cost of copper protection is, of course, greater than paint, but this is more than compensated by its lasting qualities, and in some instances, where there are difficulties in reaching the work to paint it, as in high towers, lighthouses, etc., its use would seem to be particularly indicated.

For inside work, where plating is used more for effect than as a protection, zinc, tin, or aluminum is generally added to the bath to give the copper a bronze appearance, and a coat of 2 or 3 ounces to the square foot will suffice. Electro-bronzing has been used extensively for ornamenting inside iron work in recent years, much more so than copper plating has been used to protect outside work, which is comparatively a new use for copper plating. But this use is extending all the time. Architects are quick to see the advantages of an impervious coat of copper on iron work, which overcomes the most objectionable features of iron for architectural use, rusting, and the constant expense of keeping it painted. A notable example of both kinds of plating will be seen in the new Bourse building, about to be erected at a cost of, outside of the land, $1,000,000, in Philadelphia. The outside iron work, such as the window frames, will have a heavy protective coat of copper deposited on them and the inside work will be electro-bronzed.

As I have said, great improvements have been made in the solutions and methods used. In France, where copper plating was first used to protect iron, the copper was not deposited directly on the iron, but on a coating of varnish rendered conducting with plumbago, or powdered copper, applied to the iron surface and allowed to dry. This was done to avoid the difficulties of cleaning the cast iron and the use of two solutions in depositing the copper, as the object, after the varnish was dry and the plumbago applied, was placed directly in the acid solution. This method gives a coating that is not firmly attached, and is liable to be torn off on coming in contact with any hard object. Examples of this system of plating may be seen on the lamp-posts of Paris and on the beautiful fountains of the Place de la Concorde and of the Place Louvois. The method used in this country deposits the copper directly on the iron, and a sheet of steel or iron so plated may be bent or twisted into any shape without the copper becoming detached. To attain this result, the greatest care must be taken in cleaning and keeping clean the iron surface before immersion in the plating solution, in this case a cyanide one, which, when properly made, is run cold and deposits the copper in a bright state. The acid solutions have also undergone improvements, and copper can now be deposited at the rate of 20 to 25 ounces per square foot that is as malleable and almost as smooth as rolled copper. The density of current can also be much increased over what was formerly believed possible. The writer has deposited copper $\frac{1}{8}$ inch thick at the rate of 10 pounds per square foot in 24 hours. (The usual rate is about 8 ounces in 24 hours.) This would take only one-twentieth the time usually required for obtaining a shell in electrotyping. Another new application of copper plating is the manufacture, quickly and cheaply, in copper, of all kinds of raised mouldings and of artistic objects in bass-relief. This is done by first preparing thin sheets of copper by electro-deposition on a prepared steel surface, then stripping them off and stamping the design, in relief, on them, and, after stopping off the face, backing them up in the bath with more copper to the required thickness.

Signs are also made by electro-deposition; but this is only a form of electrotyping, although the finished result when nickel or silver plated is very beautiful.

There are other minor applications of this kind that are new, but would take too much space to describe, such as the plating with copper of natural objects, leaves, flowers, etc., attached to brush and mirror backs. The brush or mirror and spray of leaves or whatever may be used, is rendered conducting by a new process, which does not include bisulphide of carbon in its application with its attendant dangers of explosion and fire.

The manufacture of metallic papers by depositing copper on a prepared surface and then pasting paper thereto and stripping the two off together.

The latest and most interesting proposed use of copper plating is the protection of ships' bottoms. By a recently patented method copper can be applied quickly and cheaply in sections, which overlap each other, to the hull of the vessel during construction, or it may be applied to vessels already built.

The above are a few of the new applications of copper plating, and serve to show the progress that has been made in the art. J. D. DARLING.

MR. THOS. H. COX, of Chamberlain, South Dakota, furnishes us with the description of a new artesian well lately drilled at that place. The well is situated 1,342 feet above the sea level, and is about 200 feet from the Missouri River. The well is 8 inches in diameter and is 602 feet deep. The drilling consumed 17¾ days and was proceeding in the usual manner without meeting any obstruction until August 2, when a light flow commenced and the drilling was continued until 4 A. M. the next morning, when the tools were thrown out. The pressure increased until the column of water ejected reached 13 feet 2 inches in height. This is the third artesian well in the city, and will be utilized for power for a flour mill and electric light plant. One of the other wells, 6 inches in diameter and 760 feet deep, exerts a pressure of 117 pounds to the square inch.

THE WORLD'S COLUMBIAN EXPOSITION—A VIEW FROM THE FERRIS WHEEL.

The charm of the Midway Plaisance is due to that strange medley of colors and costumes that change each minute like the pieces of a kaleidoscope. In this truly cosmopolitan street children of the desert, savage warriors from Dahomey, tall Copts, swarthy Nubians and crafty Cairenes are brought into curious juxtaposition with the electric scenic theater, the ice railway and the Ferris wheel—all the products of the civilization of the nineteenth century. The chance of a trip around the world does not come to all; but here are collected together what would require the expenditure of months of time and thousands of dollars to see elsewhere. The whole world, civilized and uncivilized, has been laid under contribution, and the result is a collection of shows which is absolutely unique, and which give perhaps as keen a sense of mental refreshment and mental acquisition as any portion of the Fair, except the effect of the architecture, which is supreme.

The Midway Plaisance comprises a strip of land between Fifty-ninth and Sixtieth Streets, extending from Stony Island Avenue, which borders the Fair proper, to Cottage Grove Avenue. It is here that all the concessions in the way of shows have been granted, with the exception of the Esquimaux village, which requires the use of a pond, and some of the ethnological shows, which are properly placed near the Anthropology building. There are several entrances to the Midway Plaisance, and it is also reached by the open passageway near the Woman's building. Admission to the grounds proper also includes the Plaisance. A viaduct has been built to allow the Illinois Central tracks to cross, and some of the streets also cross the Plaisance, as will be seen by our bird's-eye view. The Plaisance is a particularly delightful place to spend an hour or two after fatiguing sight-seeing, and the time is well spent, as the Plaisance is full of knowledge which can be pleasantly acquired. Let us suppose that we have been walking around for four hours amid dynamos and rock drills, looms and wall paper, until the head whirls and the tired feet almost refuse to obey. Passing under the Stony Island viaduct, we are in a new world, which, while it does not pretend to instruct, still conveys quite an amount of real knowledge, though carefully enshrouded in a sugar-coating of amusement.

The most conspicuous object by all odds is the great wheel which rises a half mile below. Chicago has a yearning for the superlative degree even more than Eastern American cities. This is abundantly shown by the tall buildings which grace this city; but it is a lucky chance that a tower was not selected as the great feature, for in that case Chicago would never have rested until Eiffel had been out-Eiffeled by a tower 2,000 feet high, and as Chicago comes by her title of the "Windy City" honestly, it would be impossible to state the consequences. This is the biggest wheel on earth, and is devoted to giving pleasure by swinging the visitor up two hundred and fifty feet; in other words, it is a colossal merry-go-round; for at the extremity of each spoke is attached a car, so that the visitor can make the whole revolution with safety. Let us for once pay our fifty cents, start on our trip and examine the objects which the revolution of the big wheel brings into view. Looking toward the main Fair grounds, we get a fine bird's eye view of the Plaisance. At the extreme left, just by the viaduct, will be noticed a few people just entering the Cairo Street, which is on many accounts the most attractive feature in the Plaisance. Here the donkey boys scream "Yankee Doodle donkey! Bismarck donkey!" at the top of their voices, and describe in glowing terms the delights of a camel ride; but woe to the unwary who trust themselves on the back of this conveniently jointed animal, if they are subject to sea sickness, for the English Channel would prove a paradise in comparison; but, luckily, twenty-five cents does not rent a camel for a very lengthy period. Egyptian goods of all sorts are sold in the street and it is a very good place to buy souvenirs. A little farther down the Cairo Street is the theater which presents the national (?) dances of Egypt. These dances are reprobated by ministers and moralists, but of course it is necessary for them to see them "just once" before they can paint their sinfulness in lurid characters. And then they are "national."

Just beyond the Woodlawn Avenue viaduct is the German village. The German village partakes more or less of the German character, the tower of the German museum rising picturesquely above the trees suggests Nuremberg or Ratisbon. The greater part of the German village is taken up by a beer garden. Here the Germans and many who are not Germans quaff the cooling beverage and listen to one of the two German military bands which play delightfully. Beyond the half-timbered German house the thatched roof of the Dutch settlement or Javanese village, as it is usually called, will be noticed. In this village dwell the curious little people who have won all hearts by their natural and graceful manners. In the large hall refined dances are given many times a day to the plaintive melodies of the country, rendered by a native orchestra. The little matting houses are delightfully cool and the delicious tea and coffee of Java are dispensed by some of the 125 natives who people the village. The whole entertainment in the Javanese village can only provoke approval, and the dancing pavilion can be visited by ladies without the necessity of going out because of the immorality of the performance. Just this side of the second viaduct will be noticed the three odd-looking roofs of the Japanese bazar, where thousands of visitors buy souvenirs, for the goods are not only attractive, but the prices are low. Beyond the second viaduct will be seen the Libby Glass Company's furnace. The enterprise of this firm is shown by the erection of an expensive plant, and the small admission fee is credited upon any purchase. Here are shown the processes of glass blowing, glass cutting, and glass spinning. To the left will be noticed the round tower of Mrs. Hart's Irish village. Entering the St. Lawrence gateway (Drogheda), we ap-

THE WORLD'S COLUMBIAN EXPOSITION—VIEW FROM THE FERRIS WHEEL.

proach Donegal Castle. In the green is a Celtic cross, and round it the merry Irish lads and lassies dance on moonlight nights to the sound of the pipes. Irish industry and Irish art are well shown in this inclosure. Passing under the railroad tracks and the Stony Island Avenue viaduct, we emerge into the main Fair grounds.

In our illustration the Woman's building rises directly in front of the entrance to the Plaisance. The towers of the Fisheries building may be seen in line over the Libby Glass Works, while on the left the homely dome of the Illinois State building is seen. At the extreme left is the Art Gallery, over the other end of the Woman's building is the Government building, and on the extreme right rises the immense Manufactures and Liberal Arts building, with the low dome of the Horticultural building in front.

As the great wheel revolves once more, let us examine the buildings on the right of the Plaisance. The lofty minaret of the Moorish Palace rises in the foreground, while beyond the viaduct is the Turkish village, composed of several isolated buildings. Here are mosques and bazars, and a Turkish street filled with venders of rugs and cigarettes. In a small booth just beyond the mosque, "Turkish soft drinks" are advertised, but let the stranger beware of these Oriental compounds. Just before reaching the large panorama of the Bernese Alps will be seen the long, low Turkish theater. Our ideas of the dramatic art of the Ottomans will be very much modified after witnessing one of the performances. "A Marriage in Damascus" is very well rendered; a special man—he might under some circumstances be called an interpreter—makes pitiful attempts to give an English version of the dialogue and fails. Beyond the panorama is the Natatorium and the Vienna restaurant, which come in for a large share of patronage. James J. Corbett has just completed an engagement at the Natatorium. The Hagenbeck animal show is well worthy of a visit, and is conveniently situated just beyond the second viaduct. Here Miss Lilly, the dwarf elephant sulks, or rather did sulk, for she died recently, in a corner. The performing animals are really wonderful, and it is a strange sight to see a maned lion riding on a tricycle. He realizes his disgrace, and looks deprecatingly at the audience, as if to say, "How low I have fallen!" The Venice-Murano Glass Co. have a fine building opposite the Libby Company's building, and here they exhibit the manifold steps in the process of making some of the beautiful but fragile Venetian wares. The Blarney Castle next greets our eyes, and the bird's eye tour of the Plaisance is finished just as the wheel lands us at the platform, and the guard calls, "All out," and we pass down the Plaisance, and out to the Sixtieth Street station of the Illinois Central Railroad.

The Plaisance is Nijni-Novgorod brought to our very doors, and the curious street is even better, for the Plaisance contains a more heterogeneous collection of people than the great exchange of Asia and Europe can show, for here are also assembled the natives of America, Africa and Oceanica.

The Dog and the Bicycle.

A Broadway car bowled past Grace Church on a Sunday afternoon. A man stood on the back platform, turning every little while to encourage a big dog which trotted along behind the dashboard and apparently didn't mind the speed at all.

Sunday bicyclers infest Broadway and seem to find the broad iron strip for the cable a beautiful roadway. Behind the panting dog on the car track was a pneumatic-tired bicycle. The rider sometimes got unpleasantly near the big dog, who barked vociferously to show his displeasure, but the wheel kept close to his heels.

Whether the dog knew the sort of tire attached to the wheel or whether he didn't will probably never be known, but as the car slacked up at Thirteenth Street the canine turned, and stepping aside, made a vicious snap at the slowly revolving wheel. His sharp teeth punctured the tire, the pressure drove out the air, and the rider found himself with a collapsed tire and a useless bicycle. By the time the rider discovered what had happened, the dog, relieved of his pursuer, was half a block away. The wheelman took to the sidewalk and pushed his machine home.—*N. Y. World.*

Fish Oils.

The examination of a number of different fish oils demonstrates that the solid fatty acids are made up in the main of palmitic acid, with small quantities of stearic acid; the liquid fatty acids are not identical with any of the known acids: *Asellic acid*, $C_{17}H_{32}O_2$, and *jecoric acid*, $C_{18}H_{30}O_2$, isomeric with linolenic acid, to which the easy oxidation of the oils is due; both of these acids are oxidizable by alkaline permanganate of potassium solution, yielding characteristic oxy-acids; the ultimate analysis of the oxy-jecoric acid gave results indicating the presence of a third acid, possibly isomeric with linolic acid.—*Dr. W. Fahrion, Chemiker Ztg.*

POSITION OF THE PLANETS IN SEPTEMBER.

JUPITER

is morning star. No one will dispute his right to take the first rank on the September planetary record. He is fast regaining that brilliancy which at times is sufficient to cast a shadow and to enable observers gifted with phenomenal eyesight to hope to read newspaper headings by his light. As the revolving earth draws nearer to him, it is safe to say that his surface will be scanned as it never was before. Recent discoveries have aroused an eager interest in this most important member of the system and in everything connected with his movements, the constant changes in his disk, the number, shape, and revolutions of his satellites.

Jupiter is stationary on the 19th, and then commences to slowly retrograde or move westward, holding in this course beyond the end of the present year. This apparent change of movement in Jupiter is due to the superior speed of the earth in its interior course, as both planets circle in the same orbital direction around their common master, the sun.

Jupiter is to be found in the constellation Taurus. There is no need of pointing out his exact position, for his own superiority in light and beauty leaves him without a rival in his field. Still he has interesting neighbors, the Pleiades being a few degrees toward the northwest, while Aldebaran and the group of the Hyades are about the same distance to the southeast. When the month closes Jupiter will rise about eight o'clock in the evening and will be in fine position for observation.

The following are among the most interesting configurations of the satellites of Jupiter, and are selected from the Nautical Almanac. They are for an inverting telescope, and the exact hour to look for them is midnight after the given day:

On the 5th I. is occulted, III. is on the left or western side of the planet, II. and IV. are on the right or eastern side.

On the 9th II. is making a transit, IV., I. and III. are all on the right and quite close to each other and to the planet.

On the 10th III. is making a transit, II., I. and IV. are on the left and quite close to each other and to the planet.

On the 12th I. is occulted, IV. and III. are on the left and II. is on the right.

On the 15th the satellites are perhaps in the most favorable position for being all seen at once by low powers, IV. being on the left hand side and quite separated, II. and III. are on the right and nearer together. The same configuration occurs again on the 29th.

On the 20th I. is making a transit. III. and II. are near together on the left and IV. on the right.

On the 23d II., I., III., and IV. are all on the right.

On the 25th II. is occulted, III. is on the left, I. and IV. are on the right.

On the 29th the configuration of the 15th, as given above, is almost exactly reproduced, and the apparent positions on the two dates are almost exactly identical.

Those who have telescopes of sufficiently high powers may be interested to observe the eclipses of the first three satellites and the transits of their shadows over the body of the planet. In the case of the fourth satellite the position of the nodes is such that the satellite is not eclipsed at present, nor can its shadow be seen.

The moon, one day before the last quarter, is in conjunction with Jupiter on the 2d at 1 h. 10 m. P. M., being 3° 56′ north. Four days after full the moon is again in conjunction with Jupiter on the 29th at 7 h. 31 m. P. M., being then 4° 47′ north. At this time the moon will here be on the eastern horizon, and when Jupiter rises, say one-half hour later, the two will form a charming picture.

The right ascension of Jupiter on the 1st is 3 h. 56 m., his declination is 19° 20′ north, his diameter is 39″.6, and he is in the constellation Taurus.

Jupiter rises on the 1st at 9 h. 55 m. P. M. On the 30th he rises at 8 h. 2 m. P. M.

VENUS

is evening star. Her apparent distance from the sun increases very slowly as she follows and gains upon the earth. Venus sets at the beginning of the month about an hour and a quarter later than the sun and at the end of the month an hour and a half later. Her light gains in brilliancy about one-fifth during the month, but her southern declination, which increases very rapidly during the same time, will prevent her from being the conspicuous object that we are accustomed to regard her.

From September 8 to September 11 Venus will be within three degrees of Spica Virginis, passing a little more than two degrees to the north of Spica.

The moon when a three days' old crescent is in conjunction with Venus on the 13th at 12 h. 19 m. A. M., being 0° 30′ south. The resulting occultation of Venus will not be visible to us, as both moon and Venus will then be five hours below the western horizon, but on the evening of the preceding day, Tuesday, September 12, the crescent moon, Venus and Spica Virginis will be so close to each other as well to merit attention.

The right ascension of Venus on the 1st is 12 h. 44 m., her declination is 4° 12′ south, her diameter is 12″.8, and she is in the constellation Virgo.

Venus sets on the 1st at 7 h. 42 m. P. M. On the 30th she sets at 7 h. 8 m. P. M.

SATURN

is evening star, but is rapidly approaching the sun. Its distance from the earth is increasing and has nearly reached its maximum. During the greater part of the month Saturn may be said to be lost in the sun's rays. It sets quite soon after the sun throughout the month, at the beginning one hour and twenty minutes, at the end only twenty minutes or so.

The moon when two days old is in conjunction with Saturn on the 12th at 12 h. 47 m. A. M., being 1° 48′ south.

The right ascension of Saturn on the 1st is 12 h. 45 m., his declination is 2° 25′ south, his diameter is 14″.8, and he is in the constellation Virgo.

MARS

is evening star at the beginning of the month and morning star at the close. He is in conjunction with the sun September 4, 4 h. 18 m. A. M., at which time he changes from evening to morning star. At the same time he is at very nearly his greatest distance from the earth and shines with only about one-fortieth of the brightness of a year ago. Mars, though morning star, may be said, like Saturn, to be lost in the sun's rays, for even at the end of the month he rises only forty minutes before the sun.

The moon, a few hours before the change from old to new, is in conjunction with Mars on the 9th, at 8 h. 50 m. P. M., being 2° 7′ north.

The right ascension of Mars on the 1st is 10 h. 49 m., his declination is 8° 42′ north, his diameter is 3″.8, and he is in the constellation Leo.

Mars sets on the 1st at 6 h. 32 m. P. M. On the 30th he rises at 5 h. 10 m. A. M.

MERCURY

is morning star at the beginning of the month and evening star at the close. He is in superior conjunction with the sun on the 20th at 3 h. 16 m. A. M., when he changes to the eastern side of the sun to commence his short career of evening star. An experienced eye might possibly pick up Mercury at the beginning of the month, but generally he will be invisible to the naked eye.

The moon one day before its change from old to new is in conjunction with Mercury on the 9th, 5 h. 58 m. A. M., being 1° 59′ north.

The right ascension of Mercury on the 1st is 9 h. 44 m., his declination is 11° 42′ north, his diameter is 6″.0, and he is in the constellation Leo.

Mercury rises on the 1st at 4 h. 15 m. A. M. On the 30th he sets at 5 h. 56 m. P. M.

URANUS

is evening star, not very far removed from the sun, especially at the close of the month, and invisible to the naked eye.

The moon four days before the first quarter is in conjunction with Uranus on the 14th, at 1 h. 55 m. A. M., being 2° 14′ south.

The right ascension of Uranus on the 1st is 14 h. 22 m., his declination is 13° 41′ south, his diameter is 3″.6, and he is in the constellation Virgo.

Uranus sets on the 1st at 8 h. 44 m. P. M. On the 30th he sets at 6 h. 54 m. P. M.

NEPTUNE

is morning star. This remotest member of the solar system is to be found about as far to the northeast of Aldebaran as Jupiter is to the northwest, but he will require optical aid to pick him up.

The moon on the day of her last quarter is in conjunction with Neptune on the 3d at 10 h. 0 m. A. M., being 5° 45′ north, and five days after full is again in conjunction with Neptune on the 30th at 3 h. 31 m. P. M., being 5° 59′ north.

The right ascension of Neptune on the 1st is 4 h. 49 m., his declination is 20° 55′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 10 h. 45 m. P. M. On the 30th he rises at 8 h. 47 m. P. M.

Mercury, Venus, Saturn and Uranus are evening stars at the close of the month. Mars, Jupiter and Neptune are morning stars.

THE HARVEST MOON

is the full moon which occurs nearest to the autumnal equinox. This year the autumnal equinox is on the 22d of September. The sun enters Libra and autumn commences September 22, 2 h. 55 m. P. M. The September moon fulls on September 25, 3 h. 23 m. P. M., and is, therefore, the harvest moon. The full moon next following, that is, the October full moon, is called the Hunter's Moon. The phenomenon known as the Harvest Moon is the, so to speak, coasting of the nearly full moon along the horizon at the time of rising, in consequence of which for several days preceding and following the day of full, the nearly full moon will have smaller intervals between its successive risings than at any other period of the year. This year the phenomenon of Harvest Moon will be particularly marked, and the lowest interval possible in New York, namely, 23 minutes, will be reached.

THE WORLD'S COLUMBIAN EXPOSITION—INTERIOR OF WOMAN'S BUILDING.

The accompanying illustration shows the interior of the Woman's building, looking from the north corridor over and across the rotunda in the central part of the building. This building is two stories high, with a series of rooms on each side which open into this rotunda, both on the main floor and in the gallery. The rotunda is 70 feet long by 65 feet wide and reaches through to the roof of the building, where it is covered with a skylight. The walls of this rotunda are hung with pictures exhibited by the United States, Great Britain, Germany, Austria, Italy and other countries, while the floor is occupied by forty or more cases in which there are displayed the choicest specimens of the handiwork of women in all parts of the world. Scattered about among these cases are pieces of statuary in marble and bronze. Across the south end of the building, seen in the distance in the picture, is the south wing, which is devoted to exhibits from foreign nations. The north wing, immediately back of the spot where the picture was taken, contains exhibits of the United States and also a few foreign exhibits. On the ground floor are salesrooms, together with other rooms devoted to the display of exhibits. Much of the southern end of the gallery in the south wing is devoted to an overflow exhibit room, and in this and the adjoining room, called the organization room, are the headquarters of fifty or more philanthropic and religious societies. Along the west or right-hand side of the gallery are exhibit rooms, record rooms, a library fitted up with much taste and the Connecticut room. On the east gallery or left-hand side, as seen in the picture, are the Kentucky, Cincinnati and California rooms, each fitted up and furnished by women from these places. The California room is especially rich in the display of redwood, with which the room is entirely finished and mostly furnished. In the north wing of the building, immediately back of the corridor from where the picture was taken, is the Assembly room, in which all the meetings under the auspices of the Board of Lady Managers are held, and opening out of this is the model kitchen, where frequent lectures and lessons in cooking are given.

Since there have been threats of war between France and Siam, the Siamese exhibit in the Manufactures and Liberal Arts building has attracted more than usual attention. This exhibit was described in the SCIENTIFIC AMERICAN of July 1.

THE WORLD'S COLUMBIAN EXPOSITION—INTERIOR OF WOMAN'S BUILDING.

Dogs as Draught Animals.

Among the reports from the consuls of the United States for July is the following, from the American consul at Liege, Belgium:

The first distinctive institution that attracts the attention of a stranger in Belgium is the working dog. From time immemorial this hereditary loafer has been given over to pleasure; but, like certain other of the privileged classes in this revolving world of ours, he has had his day—at least in Belgium. Such amateur service as he has rendered in the past in aiding the shepherd, guarding the household, and rushing with sledges through the frozen regions of the north is too much in accordance with his instincts to be classified as labor; so it is here, for the first time in his history, that the necessity of doing something for which a natural repugnance is felt (and this, I believe, constitutes the essential difference between work and play) has been forced upon him; but, like the old *noblesse*, he accepts the change cheerfully and patiently performs his task. Sentimentalists, taking no thought of the man or even of the woman whose burden he shares, may complain that he is greatly wronged; but sensible people must rejoice that he has at last been set to work and compelled to earn his own living.

Liege is a city of large wealth and great industrial activity, possessing the largest manufactory of machines and machinery in the world and employing as many horses as any other town of its size in Europe, and yet for every horse at least two dogs are to be seen in harness on its streets. They are to be met at all hours of the day, but in the early morning the boulevards are literally alive with them. Traffickers (mostly women) with gayly painted carts drawn by well-fed dogs are then seen striving to be first in the market place. A pretty bare-headed Walloon peasant girl moving briskly at the side of a flower cart drawn by a stalwart mastiff is a pleasing vision to the early riser. But not only the gardener, but also the butcher, the baker, the grocer, the porter, the expressman—common carriers of all kinds, indeed—engage his services. His step is so much quicker than that of the horse that he will in an hour cover twice the distance and carry with him a greater burden in proportion to his size.

Six hundred pounds is the usual draught of an ordinary dog, though a mastiff is often taxed with as much again. They are driven single, double, and sometimes three and four abreast, and are hitched, indifferently, in front of, beneath, or behind the cart or wagon. When the vehicle is loaded, the driver walks, directing its course and in emergencies laying his shoulder to the wheel; but when the load has been discharged, he often mounts the box and rushes like Jehu through the streets. It will not surprise those who know that the steam engine was familiar to the Romans as a toy to be told that the hollow revolving cylinder used in squirrel cages has been turned to account here in the movement of light machinery by enlarging its scale and substituting "Fido" for "Bunny." I have also seen him treading an endless belt in the service of a wood sawyer. A gentleman of Liege, retaining his fondness for lounging upon the boulevards after losing the use of his legs, had a perambulator so constructed that a Danish hound which had been his companion for years could be hitched and almost concealed between the wheels, and now appears as regularly in his old haunts as any of his friends. The hound is not only as happy as when he loitered at his master's heels, but is manifestly proud of the service he renders him.

Let it not be forgotten that the Belgians are among the most refined and cultivated people on earth, and that this new use of the dog is one of the latest and most approved developments of their civilization. Thirty years ago, I have no doubt a dog in harness would have excited as much remark in this city as he would to-day in Louisville or Memphis, though he is now as well recognized an institution of the people as the mule is in either of those cities.

Rigorous discipline and the long habit of wearing muzzles seems to have subdued the belligerent instincts of these dogs, for they now meet as strangers at the crossings without those supercilious inspections and hostile demonstrations which characterize both men and dogs till they have received the last touches of civilization. There remains, however, a rudimentary love of the chase, of which the artful driver often avails himself to quicken their speed; though, as Lord Chesterfield in his excessive refinement is said to have laughed without cachinnation, they have learned to hunt without barking. But a more interesting incident of their labor is the complete extinction of the sheep-killing propensity. Gentlemen bred in the country assure me that this offense against pastoral morality is no longer known in Belgium—a reformation which would in itself justify the harnessing of all the dogs in America.

The expense of feeding them where a number are kept or when placed, like horses, at livery is from 5 to 6 cents per day, horseflesh and black bread forming the staple of their food; though here, as elsewhere, the maintenance of one or two in a family is practically without cost. The expense of shoeing, no small item to the keeper of horses, is also saved.

All the experiments of breeding which have from time to time been tried for the improvement of horses are now being made to produce a dog of special fitness for harness. Newfoundlands and rough-coated St. Bernards are ruled out on account of their hair. The mastiff has been found too long in the back and legs, and it is thought a desideratum to graft the splendid chest and breathing capacity of the bulldog upon this stalwart stock. Markets are established, where they are bought and sold like their equine colaborers at Tattersall's, and it is no unusual thing for a compactly built and well-broken dog to sell for $20 or $25.

It is the fashion in America to bewail the loss of power at Niagara, though no thought is taken of that equal force which is running to waste at the very heels of the people. Since the days of Caligula horses have fed upon golden oats, and yet an energy which is free, always at hand, and aching to be employed is still everywhere ignored. Without having the census at hand, I assume that there is a general average of one dog to two electors in the United States, giving us, in round numbers, a canine population of 7,000,000. Estimating the strength of a dog at 500 pounds—and it is a low estimate—we have an idle force in America of 3,500,000,000 pounds, or a power which, like faith, if once exercised could remove mountains. But it is not in its mass, but in the simple divisions in which we find it, that its value consists.

Though the inanimate forces are doing the heavy work of the world, a multitude of minor tasks to which they cannot be profitably applied remain to be performed by man and his domestic assistants. For them the horse possesses superfluous energy, and his maintenance is too expensive for the poor. They are left, therefore, to this clean, cheap, noiseless, and intelligent animal—the dog—who, besides being out of business—for even hunting dogs are following hunting nobles into oblivion—seems to be specially fitted by nature to meet the requirement.

There is not an article of merchandise, from a ton of coal to a loaf of bread, sold in any of our cities which might not be more advantageously delivered by dogs than by horses. The noise made by hucksters, particularly in early morning, in our residence streets is a source of great annoyance to the sick and nervous, and the substitution of the gentler ways of women and the silent trade of dogs would be hailed by them with joy. Nor would their employment be without a certain municipal advantage, for the litter made by horses is the most fruitful source of dirt in our cities, to say nothing of the great saving in the wear and tear of pavements. NICHOLAS SMITH, *Consul.*

Liege, June 3, 1893.

Electrical Power for Brick Machines.

In Auburn, Me., Mr. Charles Dunn, one of the most progressive brick manufacturers in New England, has arranged an electric motor to do the work of horses in grinding. In all yards where horses are used it is an established fact that one of the greatest troubles experienced in the windlass and treadmill is the rapid decline of the horses, as the strain upon their shoulders is so great that they succumb in a very short time. Other New England manufacturers are adopting the use of electricity in their plants, and with such excellent results as to premise the opinion that it will soon become universal, so says the *Clay Record.*

A SILVER DOME FOR THE DENVER CAPITOL.—Seven thousand square inches of the dome of the capitol building are to be covered with silver, two ounces to the square foot.—*New York Press.*

RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE BOILER FURNACE.—John Milton, Alexandria, Va. This is an improvement in other boiler furnaces of the same inventor, in which air is introduced into the fire box through perforated pipes in an inclined partition above the fire, protected by water beds or refractory jackets. According to this invention, water pipes are arranged in the fire box above the fire and have communication at both ends with the water space of the boiler, the pipes supporting two layers of detachable fire brick having cavities in their adjacent faces and perforated air pipes being arranged between the layers.

Railway Appliances.

CAR TRUCK.—George F. Fischer, Rochester, N. Y. This truck consists of saddles connected with standards connected by a spring truss, a bracket connecting the saddles being supported by the truss, while also connected with the truck is a center bearing and friction rollers, the latter being received by a platform provided with slideways. The truck will support any car body, or may be used in pairs or in any desired number, or may be used without a floor as a support for a tank body, or as a flat or logging car. A special form of coupling is provided, and the trucks automatically return to the center of the body which they support when passing from a curved to a straight line of track.

COAL CHUTE.—John F. Schmadeke, Brooklyn, N. Y. For use where coal is liable to be broken by being dropped from cars on a high dump this invention provides a novel form of chute for connection with the hoppers. The chute is open at its top and has one side open, but adapted to be closed by a series of vertically sliding doors, which may be successively raised, beginning with the lowest door, so that the chute may be opened for a little distance from the bottom or for its entire height, according to the quantity of coal to be discharged.

Electrical.

BATTERY.—Charles H. Brown, Portland, Oregon. This battery has positive plates formed of an alloy of zinc and aluminum, preferably equal parts, the aluminum being first melted in the crucible and the zinc added, when the whole is agitated until the mixture is complete. Great economy is thus designed to be insured in the protection of the current, and by employing a number of positive plates, placed near each other but not in contact, the electrolyte is economized. The battery may be used for either open or closed circuit work for motors, electric lighting, etc.

Mining.

ORE SEPARATOR.—Robert Dilworth, El Paso, Texas. To rapidly separate gold and silver from sand and other tailings is the especial object for which this machine has been designed. A box-shaped table held in inclined position and supported on links carries pans separated from each other by transverse riffles, the lowermost riffle discharging into a trough through which pass the finer tailings, and there being mechanism for giving longitudinal and lateral oscillation to the table and a screen secured on it over the riffles. The heavier tailings do not pass into the riffle pans, but may be returned or delivered to a stamp for further treatment.

Agricultural.

HARROW.—Augustus Neal and Robert B. Suhr, Ashland, Neb. This is a sulky harrow in which provision is made for the use of parallel rows of teeth, to be laterally reciprocated in opposite directions when used upon an unplanted field. Means are also provided whereby certain of the teeth may be removed and a shield attached to the beams carrying the teeth in such a manner as to cause the shield to cover and protect young plants while the ground is being cultivated around them. By means of a simple and easily operated device the teeth may be made to enter the ground more or less deeply.

AUXILIARY MOULDBOARD FOR PLOWS.—Charles E. Fox, Natchez, Miss. This is an attachment to enable an ordinary plow to be used successfully in cultivating small plants, the auxiliary mouldboard facilitating the plowing of the earth around such plants without injuring or covering them. The auxiliary mouldboard is shallow as to width and has a graduated overhanging upper edge curved upward and outward from the body, the forward end of the overhanging section meeting the front edge of its body portion, while the rear section is arched over the rear upper edge of the body. By the use of this device the storage and cost of an extra implement may be avoided.

ROTARY PLOW AND PULVERIZER.—George F. Whitmore, West Union, Iowa. The rotatable digger frame has colter disks connected near their outer edges by radial blades forming buckets in which operate followers automatically discharging the dirt after it has been elevated. A pulverizing platform receives the dirt forced out of the buckets and drops it to the rear of the colter frame.

Miscellaneous.

PRODUCING CHLORINE AND PURIFYING LEAD.—Farnham M. and Cecil H. M. Lyte, London, England. This invention covers a process whereby chlorine is produced conjointly with the purification of lead and recovery of silver therefrom, the process being based upon the decomposition of a soluble chloride by nitrate of lead. The operations are carried on in a cycle, fresh quantities of lead and of calcic chloride being added for each cycle, the same nitric acid being used over and over again indefinitely, while silver is recovered as rich silver from impure lead, and pure lead is recovered, the calcic chloride liquors being decomposed into chlorine and lime.

VACUUM PUMP.—William S. Moore, New York City. This is a portable apparatus with a vacuum chamber, into which leads a pipe from a retort, in which ammonia may be subjected to heat, producing gas, which expels the air from the chamber. The exit pipe being closed, the gas is condensed by the admission of a few drops of water from a sealed cap, when, by opening a valve in an inlet pipe, the vacuum chamber may be filled with any fluid desired by placing the inlet pipe in communication therewith.

PIPE FITTING.—John McIntyre, Jersey City, N. J. This fitting is provided with an annular recess, from which extend branch openings to the pipe sections, a nut screwing in the recess to press the packing material through the branch openings into the pipe sections. A metallic packing is also provided, formed by concentric rings connected with each other by branch arms, the fitting very securely connecting the pipes with each other without danger of leakage at the joints or through sand holes or other defects in the castings.

A further patent of the same inventor provides a fitting more especially designed for pipes carrying corrosive fluid, to prevent leakage by the destruction of the threads in the couplings or other pipe fittings. The fitting has nuts having differential screw threads, and screwing one in the other, and both on the adjacent ends of the pipes, there being a packing between the nuts and pressed in contact with the joint of the pipes when the nuts are screwed up one on the other.

BRACE FOR TRENCHES, ETC.—George M. Pilcher, Logansport, Ind. A bearing block is connected with a plug in one end of an open-ended tube by a universal joint, while a head screwed on the other end of the tube has a removable outer annular section, through which a screw rod extends into the tube, a bearing block being pivotally connected with the screw rod at its outer end. The device is especially adapted for use in bracing the banks of excavations, being of simple and durable construction, easily applied and adjusted, and not liable to have any of its parts accidentally detached.

BATTENS AND PADDING IN HOUSE BUILDING.—George Knower, Greenwood, Wis. Thin, flexible lumber for making arched wooden ceilings by being bent into form, and too thin for tonguing and grooving, is liable to shrink and expose the joints—a defect which this improvement is designed to obviate. For this purpose battens of peculiar construction are provided, with padding of a paper material, so that on the shrinking of the lumber the padding and battens keep the joints closed and water and air tight. This padding and battens may be readily applied and made to serve as an ornamental finish for the woodwork.

WAGON SEAT.—Charles C. Field, New York City. This invention provides a simple and strong seat support, useful particularly on city trucks, to permit the driver to conveniently swing the seat over when not in use. Sockets are secured to supporting posts on the truck floor, and each of the sockets is formed with a rest, which is engaged by a bar hinged on the socket and fastened to the seat proper. The seat is readily swung forward and folded against the front sides of its supporting posts when not in use.

OILCLOTH CUTTER.—James W. Lewis, Ganister, Pa. Dealers who cut oilcloth from the web are provided by this inventor with a cheap and simple device by which the cloth may be conveniently measured, squared, and cut off. It comprises a guide, consisting of parallel and slightly separated strips, having longitudinal grooves in their inner edges, and a knife adapted to slide between the strips, with a guide plate at its lower end sliding between the grooves. A tape measure is hung at one end of the guide.

CABINET.—William S. Stanley, Washington, D. C. A chiffonier or chest of drawers, washstand, etc., is afforded by this improvement, the construction being such that when the cabinet is not used as a washstand or dresser, its upper portion will be closed and conceal all contained therein. The front panel may be occupied by a mirror, and brought into the best position for use without interfering with the furniture of the washstand, and the sides may be used as splashboards, with or without mirrors.

SPRAYING DEVICE.—John J. Dugan, Salem, Oregon. For spraying plants by hand, the hollow handle of this device is adapted to support any desired form of nozzle in such way that it will by gravity assume a position to direct the sprays upward, so that the water may be directed to the under sides of the leaves. The device is particularly adapted for sprinkling solutions to kill insects on the plants.

CIGAR-TIP CUTTER.—Ira C. C. Rinehart, Kansas City, Mo. This is a portable device, to be set on a counter, and it has a coil spring mechanism with revolving cutter, and an escapement with gears and trigger tripped by the entrance of the cigar tip, thus allowing the cutter to rotate and cut off the cigar tip.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HOME WARMING AND VENTILATION AND HERENDEN MANUFACTURING COMPANY'S SOUVENIR EDITION OF CATALOGUE OF FAULTLESS FURMAN HEATERS. Geneva, N. Y. 1893. 16mo. Pp. 64+288, illustrated.

Both the hot water and steam heating systems are described. The souvenir catalogue is chiefly filled with half tone cuts of houses in which the heating apparatus of the Herenden Company has been installed. The pamphlet on home warming and ventilation is composed of a collection of articles by persons who are thoroughly familiar with the subject but who are not connected with any business firm, so that their judgment in regard to various systems is not biased by mercenary motives.

ELECTRICITY UP TO DATE. By J. B. Verity. London and New York: Frederick Warne & Co. 1893. 16mo. Pp. 163. Illustrated. Price 75 cents.

This little work has now reached its third edition. We learn from the preface that the author finished his work in January, 1893. The book is intended for non-professional readers and does not go into details. It probably answers a useful purpose among this class of readers.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5320) The Harrodsburg Water Company write: Is there any phone attachment by which you can detect leaks in water pipes, such as dropping wire in service box or attaching same to pipe? Also, I have a pressure gauge at pump station graduated in pounds and feet, by which I determine when stand pipe is full. When same is at rest I have no trouble, as the hand is still and steady, but, while pump is working, the hand vibrates 15 or 20 pounds, and cannot tell when pipe is full only by stopping the pump. Is there any attachment to steady same? I take pipe to gauge out of discharge of pump. A. There has been a number of devices invented for detecting water leaks and waste from neglect during the night, by attachments to the street service pipe; some by phonograph and others by differential pressure by nearly closing the street cock. There are practical difficulties in their adaptation, mostly in the expense of maintaining a uniform system. It was tried in New York some years since, and found to cost more than the lost water. By putting a cock in the pressure gauge pipe and almost closing it, the gauge hand will not vibrate to any extent, and the mean of the small vibration will show the pressure or height of water in the stand pipe. By simply holding a rod of wood against the pipe, a current of water passing through it can be detected. If the cocks are supposed to be closed, such current would indicate a leak.

(5321) W. F. S., Jr., Sandusky, O., says: I send you a specimen of worm found in a yard adjoining our premises. It was found lying on the sidewalk under a crab apple tree. As nobody around here ever saw one like it, any information you may give in the columns of your valuable paper concerning it will be of interest. A. Reply by Professor Riley: The specimen is the larva of the Turnus swallowtail (*Papilio turnus, Linn.*), a large and handsome lemon yellow butterfly, the wings of which are banded and bordered with black. It is not uncommonly seen flitting about orchards and over meadowlands, and is one of our handsomest and most striking species. It is widely distributed, being found in nearly all parts of the United States and Canada, and its larva feeds on a great variety of trees and plants and affects particularly apple, cherry, and allied trees and also basswood. The larva occur singly and are rarely abundant enough to be of any economic importance, and have a purely æsthetic and scientific interest. The very young larvæ are black in color, roughened with brownish black tubercles. When full grown the body is smooth and greenish, thickening toward the reddish brown head. On the dorsal edge of the first segment is a raised yellow fold from which the larva protrudes, when disturbed, a fleshy, yellow, forked organ giving off a very disagreeable odor, which is the means of defense of this otherwise helpless larva against its vertebrate or other enemies. Other markings peculiar to the larva are a raised yellow fold on the hinder portion of the fourth segment, bordered with black, and an eye-like spot inclosed with black on either side of the third segment. The larva transforms to a chrysalis in the early part of August, fastening itself for support to fence posts or other objects by the help of a silken band around the middle of the body. This chrysalis changes to a dull brown color, and in this state the insect hibernates until the following spring, when the butterfly is disclosed. The first specimens of the butterflies appear during May and become more abundant during June and July, depositing their nearly round dark green eggs singly on the leaves of the food plants.

(5322) C. E. D. asks: 1. Is there any process, chemical or other, by which illustrations, half tones or even woodcuts, may be transferred onto white paper? A. We do not think there is any very satisfactory way of accomplishing this. You might, however, try saturating the print with naphtha, and applying it to the plain paper under very heavy pressure, leaving it for some hours to dry. 2. Would like to know the best method of repairing a flute of grenadilla wood that has become cracked sufficiently to slightly injure the tone. A. Probably the best method of repairing the flute will be to fill the crack with a cement composed of gutta percha, pitch and shellac, equal parts. 3. Please to give directions for making leaf photographs. A. If you refer to photographs which lie flat without mounting, we think you will succeed by stretching the paper in a suitable frame while wet, and allowing it to dry under tension. 4. At what height above sea level will eggs cease to boil, and why? What would be the temperature of boiling water at 15,000 feet above sea level? A. The height varies with the pressure of the barometer. At high altitudes water may boil at a temperature below that required for cooking eggs.

(5323) R. S. C. writes: 1. The wheel on my wagon is 3 feet 11 inches diameter. How many revolutions will it make in a mile? A. Your query is one of simple arithmetic. A wheel 3 feet 11 inches in diameter will be 12·34 feet in circumference. A mile is 5280 feet; 12·34 (the circumference of the wheel) will go in 5280, 427·7 times, which is the number of revolutions made by the wheel in the distance given, provided there are no slips. 2. Also please tell me where I can get the directions for making the telephone used by the Bell Telephone Company. A. For directions for making telephones consult SUPPLEMENT, No. 142.

(5324) J. T. D. says: I wish to build a reservoir for holding water. I want it to cover about two acres for cutting ice from. The ground upon which I wish to construct pond is partly clay and partly black loam. Can you tell me what is necessary in order to make it hold water, as I expect to get my water supply from wells outside to pond? A. In excavating for an ice pond in a mixed soil of clay and loam, the loam should be carried to the banks and the clay saved for a clay and sand or clay and loam puddle over all parts of the ground where there is no clay bottom found, and up the sides of the bank to above the water line. The clay puddle should be made as thick as the clay found in the excavation will permit, and not less than 6 inches for shallow pond for ice purposes, say of 3 feet in depth. On the surface should be spread a layer of as clean sharp sand as can be found, 3 inches or more in depth, extending to the top of the bank. This will keep the water clear and free from clay and will make clear ice.

(5325) J. A. W.—Answer by Professor Riley: The plant sent is a species known to botanists as *Exochorda grandiflora*, a species which only occurs in cultivated gardens in this country, but which is native in northern China. There are only two or three species of the genus to which this plant belongs, and all of them come from the same region in China. They are flowering plants belonging to the family Rosaceæ, and the one in question is not uncommonly met with in botanical gardens or in ornamental cultivation.

(5326) A. H. S. writes: I have a cellar walled and arched with brick, cemented inside with Portland cement, top, sides and bottom. I have it thoroughly drained. When the atmosphere is dry the walls of cellar are dry, but when the atmosphere is moist (as for instance 2 or 3 days before a storm) the walls begin to sweat, which will gather in large drops and run down to floor, making a great puddle of water. What can I apply to the walls to stop this condensation? A. The best remedy for condensation on a cellar wall is to fir off, lath, and plaster, on all parts exposed to earth backing. Only a non-conducting material between the wall and the moist air will prevent the condensation. A covering of felting would do, but should be made of asbestos or mineral wool to avoid any unpleasant odor.

(5327) G. B. writes: I would like to put up a bell in my house and use an earth connection. Now if I connect the wire with the gas pipe on second floor, and then connect the street side of meter with the house side, would I get a good earth? If not, could you tell me how to get a better one without running a wire all the way down to the cellar. A. Your proposed plan for making the ground connection is very good. We think it will be unnecessary to make a connection around the meter.

(5328) L. E. Y.—We see no fault with your diagram. Your difficulty probably arises from too much resistance in your circuit or too little battery power. Try 2 or 3 additional cells of battery.

(5329) F. W. B. asks: What is the origin of the word penny as applied to nails? A. Nails are called 6, 8, and 10 penny according as 1,000 of a particular kind weigh 6, 8, or 10 pounds; "penny" being the old term used for pound.

(5330) W. T. D.—Reply by Professor Riley: The spider sent is one of the orb-weaving species known as *Epeira domiciliorum*, Hentz. It is not

an uncommon spider and is widely distributed throughout the United States. Its beautiful regular orb webs are to be found in woods and fields, and very frequently also about dwellings and outhouses, from which latter habit it doubtless received its specific name. It establishes itself in sheltered angles of barns or porches, and if the presence of the web is no objection to the housekeeper, this spider will be of considerable service in reducing the number of house flies, for which it has a special fondness.

(5331) J. L. says: I have a twenty-five foot hull. Would you kindly recommend to me through your query column the safest and cheapest motor (no steam) that can be used for same? A. A gasoline or petroleum explosive engine is probably the cheapest and as safe as proper care and attention can make a motive power for a boat. Electric power is no doubt the safest, but has not yet arrived at a practical condition for general use. The storage electrical system is in use, but charging is not always convenient. The combined live battery and storage system is under improvement, but as yet rather a burden in a boat, from its bulk.

(5332) C. B. writes: I have found upon my tomato vines during August a green worm, about 1¼ or 2 inches long and ¼ to ⅜ inch in diameter. All over the body of this worm are little white substances, apparently eggs, sticking out straight, each one about ¼ inch long, and as thick as a hairpin wire or a trifle thicker. Each worm carries about thirty or forty of these. Will your entomologist kindly inform us to this phenomenon? Of course the worm doesn't stick these foreign bodies all over himself. What insect does it, and why? Reply by Professor Riley.—Your correspondent has observed a rather common phenomenon at this season of the year. The large green worm which he describes is one of the Sphingid caterpillars, and the minute white egg-like bodies projecting from it are the cocoons of a small black four-winged parasite (*Microgaster* sp.) A single parent fly deposits in the partially grown Sphingid larva a very great number of eggs, usually extending into the hundreds, which ultimately hatch into minute grub-like larvæ and which subsist on the fatty matter of the host larva, avoiding the vital organs. On reaching full growth, or having attained a length of about ¼ inch or less, they pierce the skin of the host larva and, remaining attached in the puncture at the posterior extremity, construct a beautiful silken cocoon which, on account of the immense numbers and close regular disposition over the back and sides of the larva, always excites the greatest curiosity when observed for the first time. Each of these cocoons, in a week or so, will disclose a small black fly, exactly similar to the one which was the author of the original parasitism. The females of these, after mating, will seek other larvæ, in accordance with their parasitic instincts. There may be several broods of these parasites in a single season, the later ones wintering over.

(5333) J. N. writes: I am making two carbon batteries, using ¾ inch carbons. I would like to know if I bored holes in the top of these carbons and filled them with hot lead, if that would make a perfect contact, so that I could solder or put set screws into it? Also the strongest carbon battery, in volts and amperes. A. You will do better if you cast your lead in a collar or cap shape around the top of the carbons. If the carbons are copper plated, tin the upper part of the copper with solder to insure contact. A battery can have any amperage. It depends on its size, nature of solution, etc. Practically 1·5 to 2 volts is the limit of E. M. F. for primary carbon batteries.

(5334) A. B. R. asks: Which of the following metals will be the most durable and have the least frictional resistance when used together, *i. e.*, one metal used in a bearing and the other in a revolving shaft: mild steel, wrought, cast and malleable cast iron, copper, brass? A. Mild steel journals running in brass boxes are considered the most durable in service and run with least friction. Wrought and malleable cast iron and cast iron, running in brass boxes, are next in order, as enumerated. Copper is not desirable as a journal box, from the difficulty of casting and fitting, although it is a good anti-friction metal.

(5335) R. H. asks: 1. Describe method of making a small electric furnace for heating soldering iron, using the Edison current. A. Use a heavy platinum coil within a chamber of non-conducing material. The coil should surround the iron. 2. Of what material is the magnet in a Thompson reflecting galvanometer made of? Would a piece of watch spring do, or would it be better to have two astatic needles? How should the needle be magnetized? A. Watch spring is excellent. For details, see our SUPPLEMENT, No. 698. 3. Is the arc light introduced into the Edison current without any resistance? A. Resistance is generally used. 4. Is the arc light used on other systems the same as the Edison, and can they be transposed? A. No.

(5336) E. L. S. asks: 1. How is a galvanic battery made, using sodium as one pole? What is the other pole composed of, that is, the bath? The electromotive force? Is it an open circuit battery? A. A sodium battery is provided with a porous cell filled with sodium amalgam. In one form the amalgam is a paste composed of 1 part of sodium and 50 of mercury. In two other forms it is a liquid composed respectively of sodium 1 part, mercury 100 parts; sodium 1 part, mercury 200 parts. The electro-motive force of the sodium battery is about 2½ volts. The other elements of the battery consist of carbon, and the electrolyte is dilute sulphuric acid. There are other combinations also. 2. How can I remove scars by electricity? A. In regard to removing scars by electricity, you should consult a competent surgeon.

(5337) J. E. B. asks for: 1. The U. S. government rule for safety valves. A. For boilers having flat or stayed surfaces, 80 square inches for every 500 feet of effective heating surface; for cylindrical boilers or cylindrical flued, 94 square inches. 2. In designing a field magnet, which is proper to use, ampere turns or amp re feet? A. Always work by ampere turns. 3. I have about 4 pounds of No. 31 cotton-covered copper wire. I wish to make a volt meter with a reading as high as 110 volts E. M. F. Would it be possible to use this wire to make a good spark coil? A. Your wire is rather too large for a volt meter, and rather fine for a spark coil. Bottone's "Electrical Instrument Making for Amateurs," 50 cents by mail, describes various electrical instruments. 4. Which is proper, ampere or amphere? A. Ampere. 5. For other definitions asked for consult the "Century Dictionary."

(5338) F. W. A. asks: 1. What horse power is one of the Edison motors, such as used in the phonograph, motor to run at about 1,500 revolutions per minute, and using a large plunge battery, such as described on page 401, "Experimental Science"? A. The power is very low, perhaps one one-hundredth horse power. 2. What is the length of time the above battery will run, giving full power, before being exhausted? A. One or two days. 3. If two of the Edison phonograph motors were coupled together, would the plunge battery above furnish power enough to run one of the Barnes 13 inch by 60 inch lathes and do work within the capacity of what a man could do on same lathe? A. No.

(5339) J. H. M. A. G. writes: I wish to light a three candle power lamp, requiring six volts, about. Will you please tell me: 1. Will three cells of storage battery be enough? A. Yes. 2. How many square inches of plate surface, including both + and —, should each cell have? A. Allow one square foot of positive plate. 3. The cells are to be made as nearly alike as can be. Will charging each cell separately for the same time with the same battery make them nearly enough alike to use together in series? It is far better to charge in series. You can, however, charge separately. 4. Will it be best to use resistance box and volt meter, so as to always obtain the same voltage through the lamp? A. This is not necessary. The batteries will be near enough. 5. With eight hours charge, how long will the storage cells run lamp? A. Fully charged, the batteries should give ten hours' current.

(5340) C. D. asks: 1. Why could not the armature and field magnets in the simple electric motor described in the SCIENTIFIC AMERICAN of March 17, 1888, be wound with No. 28 wire? A. Any sized wire could be used. The size is a matter of calculation, and depends on the E. M. F. and current to be employed. 2. Would it not increase the resistance so as to need more battery? A. It would, if wound singly, increase the resistance, and would require higher E. M. F. or more cells of battery; but such cells could be much smaller in such case.

(5341) G. D. C. writes: 1. If thirty dry batteries were put on a circuit with a simple electric motor as described in "Experimental Science," on page 408, the motor being about double the size of the one described, would it run it to its full power? If not, how many would it take? I want them to run it about three-fourths of an hour at a time. No other battery can be substituted in this case. A. Probably 200 dry cells would be required, and it is doubtful if they would run it for the time mentioned. 2. In making this motor twice the size of the other one, must I use the same size wire for the fields and armature? If not, what size must I use? A. This is all a matter of calculation. See preceding answer.

(5342) W. H. asks how to prevent barrels containing indigo extract from exploding. A. To prevent fermentation, salicylic acid or mercuric chloride might be used. By barreling the extract at a boiling temperature and closing the barrel while hot, fermentation should be prevented.

(5343) F. S. asks for a good zinc solution for plating on copper, and also the necessary acids for dipping. A. A "Watt's" solution is made by dissolving pure metallic zinc powder, by the aid of a strong current, in a strong solution of cyanide of potassium, with ammonia added. The proportions given are as follows: 200 ounces cyanide of potassium, 20 gallons of water, and 80 ounces, by measure, of strong aqua ammonia. A good dipping acid is formed of sulphuric acid 4 pounds, nitric acid 2 pounds, water 4 pounds. The fumes from the solution should not be inhaled. You will find further particulars in Watt's "Electro-Deposition of Metals," price by mail $3.

(5344) O. A. W. asks how to make nitrobenzene. A. Treat benzene with a mixture of 2 volumes strong sulphuric acid and 1 volume strongest nitric acid. Drop the benzene slowly into the mixture and filter through dry salt, after separation and washing.

(5345) J. S. M. asks: Can 20 to 30 tons of ice be put up in one ice house and keep satisfactory? About what would be the percentage of loss in one season? How large an ice house will be required, and how should it be constructed? A. Ice in quantities of 20 and 30 tons can be stored to advantage, and with a loss of no more than 10 per cent, when packed with ordinary care. Thirty tons will occupy a space of 10 × 10 × 10 feet, or 1,000 cubic feet, with 8 inches all around the inside and 3 feet at the top for packing, which may be hay or sawdust. A peak roof, ventilated, and, if possible, the ice house shaded from the sun. See SCI. AM. SUPPLEMENT, No. 59, for construction of ice houses and cold storage rooms; 10c., mailed.

(5346) R. A. S. says: A says that if brakes are applied to a car with force enough to cause wheels to stop turning and slide on rail, all power to stop train is absorbed. B claims that if brakes are not applied quite so strong, but as strong as possible without causing wheels to slide on rail, more force is exerted to stop train. Who is right? A. B is right. A skidding wheel does not hold to the track as well as a rolling wheel with the brake on nearly to the limit of the rolling traction.

(5347) F. W. L.—The ordinary newspaper pictures are produced by making a print from a negative of the same size which the newspaper print is to be. This print must be made on plain silvered paper; an artist then draws exactly the lines which appear in the picture, with waterproof indigo ink; the print is treated to a bath of bichloride of mercury dissolved in water or alcohol; this fades away the photograph, leaving only the black ink lines. The drawing is then touched up if necessary and photo-engraved like any other line drawing. The print must not be toned.

(5348) E. McC. writes: We have a woolen mill driven by small turbine, 50 feet head; mill was formerly driven by a 50 foot overshot, and think we did as much work then as now with the increased head. The turbine is liable to breakage, is delicate and so high speeded. Why would not a water motor made on principle of chain and buckets—something similar to elevators in a flour mill—with water thrown on top, or pitch back, answer every purpose without the objections of an overshot, as weight is the principle? Have you ever known such, and results? How does the Pelton wheel compare with other wheels in economy and efficiency? A. Probably your turbine is too small and does not use all the water that the overshot wheel used. If of proper size and kind, it should give you much more power with the same quantity of water and head. With 50 feet head you should realize 80 per cent of the gross value of the water fall. The chain and bucket system is of less value than an overshot wheel and has proved, so far, nothing better than a rattle trap. The Pelton wheel has proved itself one of the most efficient motors for high heads, and equal to 85 per cent of the gross water power. It is a marvel of simplicity and power.

(5349) J. B. asks: 1. Who was the inventor of piano; in what year? There is one in Louisville, Ky., made in 1776. A. The first instrument known by the name of "piano" was constructed in 1796, by Christofor. Instruments of the nature of pianos were made in 1668 and in 1821. 2. Last winter I was working at the car works in this town at night. I went into the engine room one night and sat down on the platform on which the dynamo was set, and magnetized my watch; is there anything that will save it from being thrown away? A. You can have your watch demagnetized by almost any jeweler, or you can demagnetise it yourself by suspending it on a twisted string, allowing the watch to revolve, approaching the dynamo closely while it is still revolving, and receding from the dynamo before it ceases to revolve.

(5350) L. M. asks: 1. Please inform me through your valuable paper if the amount of heat concentrated by a doable convex lens depends on the distance of focus or its diameter. If the latter, is it directly proportional to its diameter? A. The heat-gathering capacity depends on the diameter of the lens. 2. Have you any SUPPLEMENTS treating on the Wimshurst's electric machine described in "Experimental Science," by George M. Hopkins? If so, please state the number. A. You will find a number of descriptions of modifications of the Wimshurst machine in the SUPPLEMENT. Consult Nos. 548, 648, 534, and 647.

(5351) C. K. T. writes: 1. From whom can I purchase inclosed wire in quantities of two or three pounds? Please state nearest place to me. A. Address any of our advertisers who deal in scientific and electric apparatus. 2. Does the lightning which one frequently sees on warm evenings give any audible report? If not, why? A. The subject of thunder is obscure, whether as regards its presence or absence at the time of a lightning discharge. Hot-weather lightning is often produced at distant places, too far off for the thunder to be heard. 3. Please mention number of SUPPLEMENT to SCIENTIFIC AMERICAN which contains directions for making a simple electric motor. A. No. 641.

(5352) L. W. writes: I desire to construct an electric battery for general experimenting that will give a strong and lasting current, and will not be too expensive to keep in order. How should I proceed to make a one-gallon battery of this kind? Also how many cells would be required, of one gallon each, to furnish electricity for a sixteen candle power incandescent lamp? A. We advise you not to try primary battery lighting. The bichromate batteries are the best. Many varieties have been described in our SUPPLEMENT and in the SCIENTIFIC AMERICAN. Two cells to the c. p. with a 30 ohm lamp may be allowed. Our SUPPLEMENT, No. 792, gives a powerful plunge battery. We also refer you to Nos. 187, 158, and 159 for other batteries.

(5353) P. C. asks: 1. Can I successfully light a photographic dark room by electricity, employing batteries? A. Yes; but it will be expensive and troublesome. 2. If so, what is the best battery to get? A. Use a Bunsen or Fuller bichromate mercury battery. 3. What candle power lamp would it require to produce the same amount of light as a kerosene lamp employing a B wick? A. A six c. p. lamp should suffice. 4. What would be the cost of the above plant with only one light, supposing a six c. p. lamp sufficient? A. Fifteen or twenty dollars.

(5354) R. M. P. asks: 1. What size wheel and how much power can I get from an undershot water wheel, 2 feet head, and race 14 feet wide by 3 feet deep and 1,000 feet long? A. The total gross power that can be obtained from the size race stated will probably be, with a water velocity of 4 feet per second, 168 cubic feet per second falling 2 feet, 38 horse power. Of this an undershot wheel 14 feet wide, 12 feet diameter will realize about 40 per cent, or 15 horse power. A properly arranged Leffel turbine should realize 80 per cent, or 30 horse power. 2. Can you tell me the name of the firm or company that make a succession of undershot water wheels to develop power, that is, 2, 3, or 4 wheels working in the same flume? I was told they are made at Kansas City, Mo. A. We do not know of the firm that proposes to develop extravagant power from water wheels; 80 per cent of the total power is the largest known output with any known combination of water wheels for low heads. 3. How many pounds pressure is carried on small gas machines for house use? Gas to be made from gasoline. Also have you any papers on the manufacture of gas machine to light houses with? A. The gasoline vapor and air gas machines are used with from ½ inch to ¾ inch water pressure. Address Gilbert & Barker Manufacturing Co., Springfield, Mass., for their circular descriptive of their gas machines.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(5262) In issue of August 12 under Notes and Queries (No. 5262) J. B. asks is there any way to harden steel castings? I have a process of tempering cast steel or cast iron all the way through, and will be pleased to be placed in communication with him.—L. B. BROWN, 67 Jackson Avenue, Bradford, Pa.

(5278) F. K. J.—Replying to inquiry (5278) F. K. J., August 19, 1893, would suggest filling rusted pipes with a strong solution of caustic potash or preferably caustic soda of say 36° B. Solution should remain in pipes for several days.—S. C. STRUNS.

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August 29, 1893,

AND EACH BEARING THAT DATE.

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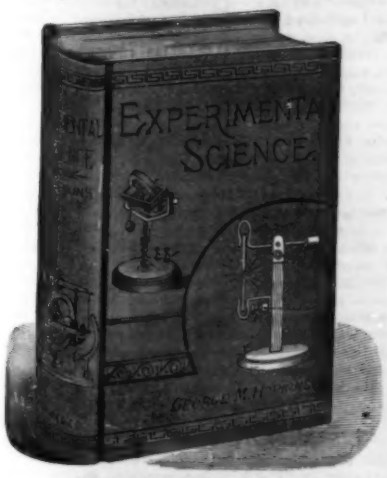

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